

PUBLIC WORKS

Jan.
1959

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HELPFUL ARTICLES
LISTED ON PAGE 5**



Thomas Calvin Robbins has been Director of the Mississippi State Highway Department for the past eight years. More data on page 18.

POWER! STRENGTH! PERFORMANCE!



GALION MODEL 160

- 160 HORSEPOWER—Cummins 6-cyl., 4-cycle diesel engine.
- WEIGHS 30,020 lbs. (with scarifier)—Correctly distributed for utmost tractive effort.
- CONSTANT-MESH TRANSMISSION—Six overlapping forward and two reverse speeds.
- HYDRAULIC SHIFTABLE MOLDBOARD—13' x 29" x $\frac{3}{4}$ " for moving big loads.
- RUGGED BOX-TYPE FRAME—Weighs 134 lbs. per foot.
- FOUR-WHEEL BRAKES.
- 14.00 x 24 TIRES—Front and rear, interchangeable.

Write for Bulletin No. 421.

THE GALION IRON WORKS & MFG. CO.
General and Export Offices—Galion, Ohio, U. S. A.

GALION
ESTABLISHED 1907



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specify

FLUSH KLEEN®

Sewage Pumps

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Solids Never Reach The Impeller,
Resulting In . . .

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- Low maintenance . . . eliminates labor of unclogging pumps
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Proven Performance Verified By Over
7,000 Installations.

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every principal city.



Putting Ideas to Work

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Pump
Company**

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Rocky Butte Jail, Portland, Oregon
Designed By Stevens and Thompson
Architects-Engineers

CAT NO. 955 TRAXCAVATOR:



**"As much work as
our shovels at just
about half the cost!"**

The Caterpillar No. 955 Traxcavator pictured above is loading dirt on a one-mile road-building job for the Town of Colchester, N. Y. This hard-working machine is part of a 100 per cent Caterpillar team that includes two D6 Tractors and a No. 12 Motor Grader.

"The No. 955 has proven far superior to the shovels we used to use," says Harry M. Shaw, superintendent. "I believe the No. 955 is doing as much work at just about half the cost!"

There are sound reasons why a No. 955 is one of the most versatile machines a municipality can own. Perfect balance of weight, power and capacity keeps the full length of the track always on the ground. A large load at every pass is assured by the 40° bucket tilt-back at ground level.

Now available on the No. 955 is the new Side Dump Bucket, capacity 1½ cu. yd. It can dump either forward or to the left, and is interchangeable with the standard

bucket—same pins, bolts and nuts used for mounting both buckets.

The new No. 955 (Series E) features new rugged track-roller frame, new solid sprockets, new heavier idlers, and new tough track rollers for the rough jobs.

Your Caterpillar Dealer has three sizes of Traxcavators in his line. Ask for a demonstration of the one best suited to your municipality. You can count on him for fast service and quality Caterpillar parts.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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**BEST BUY IN
TRACK-TYPE EQUIPMENT**

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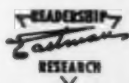
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JANUARY 1959

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Curbing pollution of Biscayne Bay

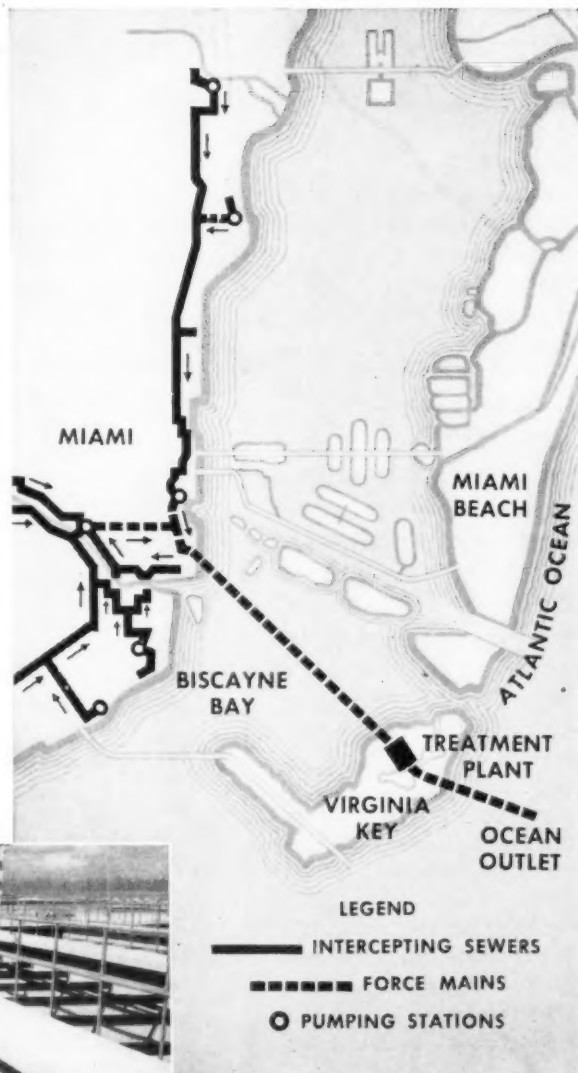
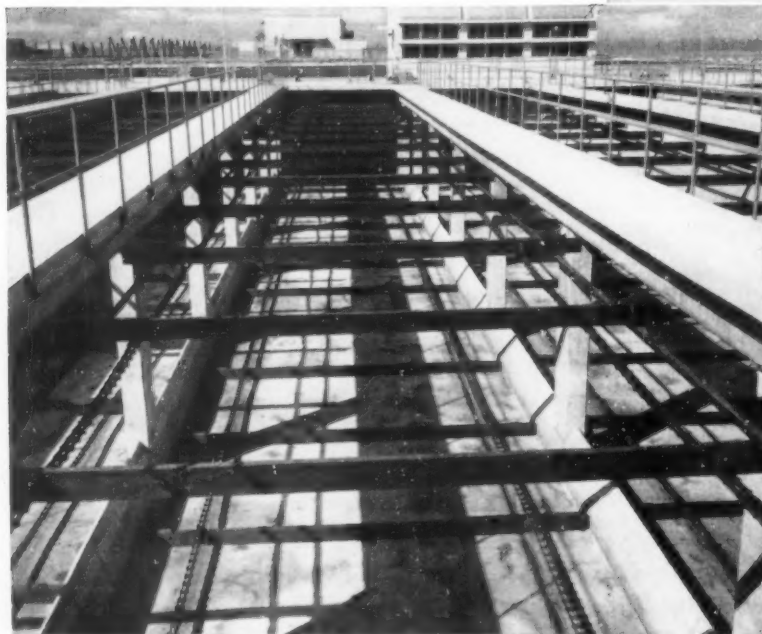
LINK-BELT equipment mechanizes sludge collection and disposal at new sewage treatment plant

Miami's recent, rapid growth has multiplied the pollution problem throughout its bay area—crimping such activities as swimming, boating, water skiing and fishing. Miami has met this threat to its tourist economy with construction of a \$27,000,000 sewage disposal project.

Inside and out, Miami's new activated sludge treatment plant utilizes sanitary engineering equipment by Link-Belt. A system of grit collectors with conveying screws and sludge collectors assists in low-cost treatment of sewage. Link-Belt bucket elevators carry liquid sludge to filters and belt conveyor . . . team up for efficient handling of the dewatered sludge. And Link-Belt Gearmotors and P.I.V. drives provide dependable power transmission for such equipment.

Link-Belt's complete line of equipment and broad engineering experience assure economical, effective water, sewage and waste treatment for municipalities and industries throughout the nation. A call to your nearest Link-Belt office will put you in touch with sanitary engineers who will work with your consultants and chemists.

LINK-BELT
SANITARY ENGINEERING EQUIPMENT



▲ **COMPLETE CONTROL PROJECT** provides interceptors, force mains and deep outfall line to deliver sewage to the Virginia Key activated sludge plant and to discharge plant effluent 4,600 feet out into the ocean. Design engineers were Rader Engineering Associates, Metcalf & Eddy and Maurice H. Connell and Associates, Inc.

◀ **BY THE DOZEN** — Here is just one of twelve Link-Belt Straightline sludge collectors operating in primary settling tanks at Miami's new plant. Sixteen Link-Belt Gearmotors drive sludge collectors and cross conveyors.

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World.



POINT OF VIEW

Getting New Ideas and Improved Designs Into Use More Quickly

ONE CAN ONLY admire and applaud the methods used by the highway industry to adapt quickly to use new ideas in equipment and improved methods of construction. A division of the Bureau of Public Roads works with the manufacturers and with contractors, developing and standardizing equipment and methods that promise faster, better or lower cost highways. The results are then generally adopted quickly by State Highway Departments.

The sanitary engineering field operates in a regrettably different fashion. Manufacturers develop and test with no, or very little, cooperation from the Public Health Service or the States. Indeed, when the new equipment is ready for sale, installation and use, the manufacturer is often told to try it out for use in some other state for a couple of years—and then it may be approved.

There is a great opportunity for a centralized leadership in the sanitary engineering field. The objective should be to cut down the difficulties and the time lag that now confront developers of new and better methods. We do not see such leadership in sight right now, but all of us can hope.

What is Best for the Community Should Govern; Not Necessarily the Low Bid

THE GENERAL requirement that a county, city, state or other public agency, on the basis of established specifications, shall receive bids and accept the lowest responsible offer is essentially a sound one. However, it has been twisted and tortured far beyond its original design. Applied to standard items, there can be no quarrel with its application; the trouble is that there has been too much stress on the "lowest" bid for many engineering installations where it should by no means apply.

Governing officials are elected as protectors and guardians of the welfare of the community. Engineers are retained to advise what is best to meet the community needs. The judgment of these men as to what is best to use is, in the absence of fraud, conclusive; and there is nothing in any law that aims to compel them to accept the lowest bid as such. All proposals should be weighed in relation to their value to the community and that one should be selected, whether or not it is low, which will accomplish this primary objective.

Fortunately much of the equipment in the public works field is of good quality and the low bid principle applies to these. However, the mere fact that a bidder is low does not qualify him as such to get the contract award; the real value to the community is and should be the determining factor.

Driveways, Curb Heights and Modern Automobiles

MODERN CARS have such restricted ground clearance that many car doors will not open if the curb height exceeds about six inches. The overhang, front and rear, has been another problem, especially in connection with driveway design. It is difficult to do much about the latter; and even if driveways could be changed, or if new designs were adopted to provide for today's cars, there is no assurance that these would be satisfactory for cars produced a couple of years hence.

Reducing curb-face height is an easier proposition. A good resurfacing job, with a gutter thickness of surfacing determined by the curb-height, will do the job. New and lower curb designs should be adopted for all new construction because it is unlikely cars will become materially higher.

Training Sanitary Engineers for Military and Civilian Needs

BEFORE World War II, the Army carried on a program of training in military sanitation which paid off thousands of times over during the 1941-1945 period. Following the war, a military reorganization made further training impossible by placing all technical and scientific personnel into a conglomerate corps heavily loaded with "the old army type." As a result, all real progress toward developing the lessons learned during the war ceased. Some attempt has been made to provide further technical training for a few individuals, but nothing has been done in the vital fields of organizing to use these technical and scientific skills, in providing an administrative overhead, in evaluating probable future needs and in establishing broad policies to meet such needs.

The Public Health Service has taken some steps to remedy this situation and has held training programs for the past two or three years. This is a laudable advance and one that is much needed; but it does not, as yet, begin to fill the overall national security needs for a comprehensively organized procedure. We hope the Public Health Service program will continue and that it will be expanded.



BELIEVE ME... M-F HAS THE
Right Approach
on HOW TO MAKE MONEY WITH A BACKHOE



Most backhoes will dig – and, they'll dig themselves into a "hole," too.

But, with this M-F Work Bull 202 rig and matched Davis Loader-Backhoe, you simply can't get cornered! Thousands have proved it!

First of all, the Davis 210 Backhoe has a hydraulic rotary swing cylinder with a continuous 200° working radius – digs or dumps at right angles to either side.

When you run into a situation that calls for digging flush alongside a wall, fence, hedge, or other obstacle – you simply move the mast and boom assembly to either end

of the frame and continue right on digging. No need to call in a pick and shovel crew.

It develops up to 10,000 pounds of break-away – handles the hardest soil, frozen ground, or asphalt paving.

Notice, you sit where you can see, and you always face the bucket.

The M-F Work Bull and Davis Loader completes the profit picture. You get out more work – than with any other rig.

Your Massey-Ferguson Industrial Dealer can help you select the right outfit, and he'll back it up with service. Write today for free literature; his name and address.



Work Bull 1001

Work Bull 303 with 500 loader and Davis backhoe

Work Bull 202 with Davis loader and backhoe

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MASSEY-FERGUSON
INDUSTRIAL DIVISION

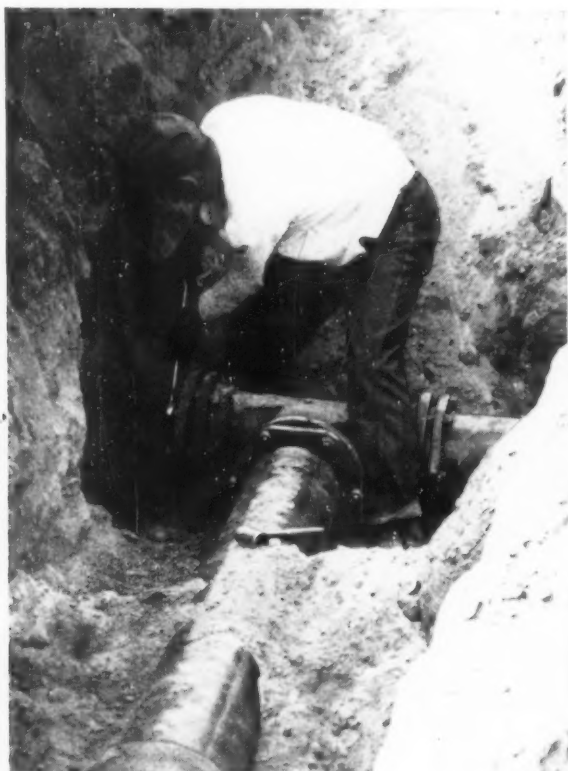
1009 SOUTH WEST STREET • WICHITA 13N, KANSAS

with hundreds of communities heard from...



CAST IRON PIPE WINS THE VOTE

Recently a questionnaire was mailed to water utility managers all over the U. S. One question asked was: *What kind of pipe do you prefer and why?* With 42 states heard from, the vote is overwhelmingly in favor of cast iron! Here are typical comments:



"1. Cast iron pipe is permanent—long life. 2. Lined pipe cuts down complaints of 'red' or 'rusty' water. 3. Mechanical joints are time and labor-saving over other types of joints, and are more flexible."

—Iowa

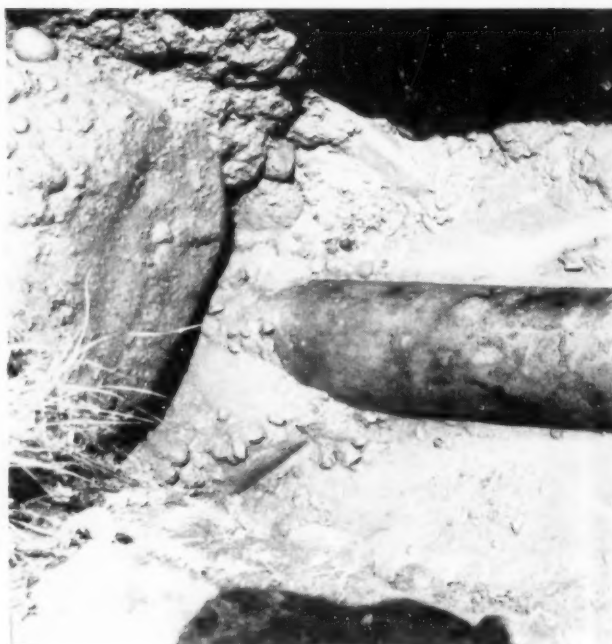
"Long life has been proven. I have personally observed pieces cut out of existing systems which were laid prior to the turn of the century. Such observations indicated the pipe to be as good as the day it was laid."

—Kansas



"Cast iron pipe has been in use for 200 years, and the record speaks for itself. All the other types have their use, but we would not recommend them in a well-built, expanding water works distribution system or large transmission lines."

—Illinois

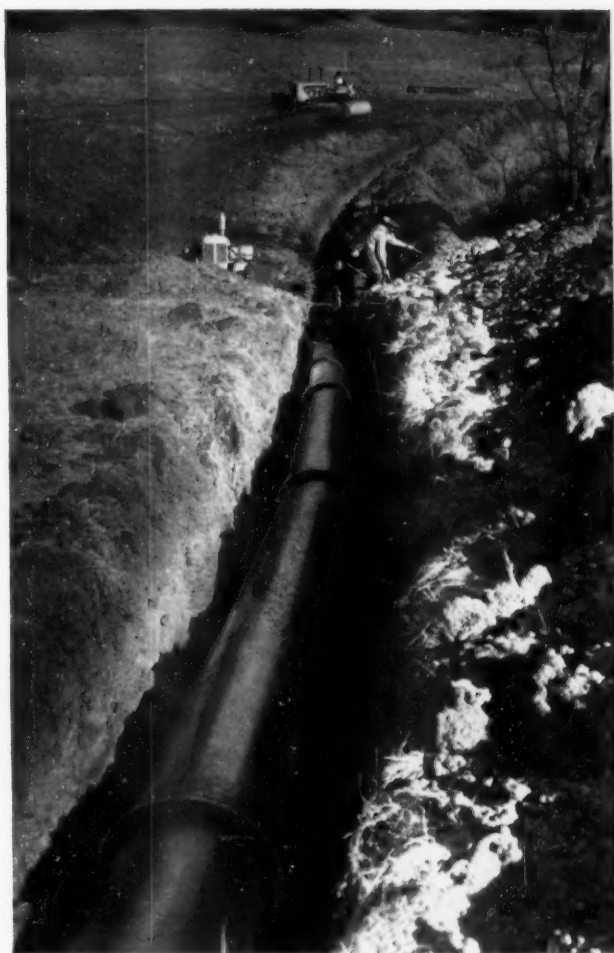


HANDS DOWN!



"We are located in a limestone area. We find cast iron pipe will absorb more rock damage than any other pipe. We also use cement lined pipe to overcome our corrosion condition which exists in our water."

—Pennsylvania



"It is very easy and fast to lay, and you can swing the joint enough in places where you can save time and money."

—New Jersey

Three reasons why cast iron pipe is America's greatest water carrier:

1. More miles of underground cast iron water mains are now in use than of all other kinds of pipe combined.
2. More miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.
3. Impartial surveys prove that today's water utility officials and consulting engineers prefer cast iron pipe for underground water distribution by an overwhelming majority.

... *good reasons for you to choose*

CAST IRON PIPE

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

Use VITRIFIED CLAY UNDERDRAINS in your Trickling Filters and

PERMANENCE

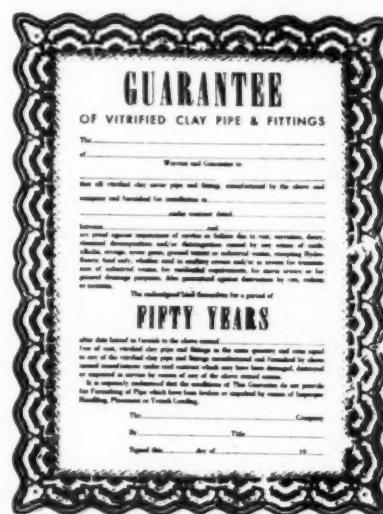
Since a Trickling Filter can be no better than its underdrain system, it is vital that the floor blocks be of vitrified clay. They guarantee permanence with protection against acids, alkalis and bacterial action that blocks made from substitute materials cannot possibly give.

The 50-Year Guarantee shown here is an assurance that cannot be had from makers of any material but vitrified clay. It means that you can specify and use TFFI vitrified clay blocks with confidence—confidence that no filter bottom will have to be torn out for replacement a few years later.

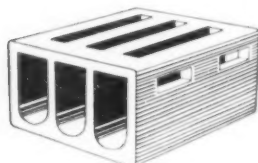
MADE ONLY IN MODERN PLANTS

A further protection to engineers specifying vitrified clay underdrains is that these blocks are made only in modern plants, under controls mechanically impossible with any substitute.

50 YEAR GUARANTEE

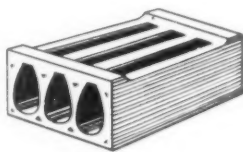


TRICKLING FILTER



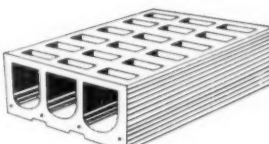
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Pomona Terra-Cotta Co.
Greensboro, No. Car.



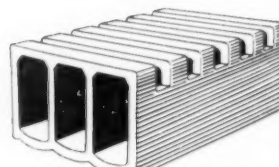
NATCO

Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.



DICKEY

W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.



TRANSLOT

Texas Vitrified Pipe Co.
Mineral Wells, Texas

be **SAFE**

"There is hardly anything in the world that some man cannot make it a little worse and sell a little cheaper and the people who consider price only are this man's lawful prey."

—Ruskin

TFFI specification blocks, Fort Worth, Texas trickling filters. Freese and Nichols, designing engineers.

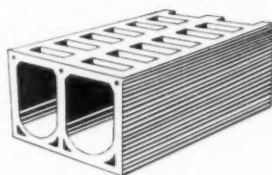


SPECIFICATIONS

ASTM specifications insure good trickling underdrains—insure that you get the best. Ask any member listed below for a copy of approved Specification ASTM C-159-55.

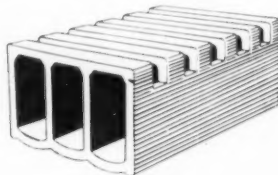
Address any member of the Institute for full details and suggested specifications for blocks.

FLOOR INSTITUTE



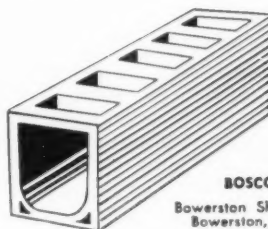
ARMCRE

Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



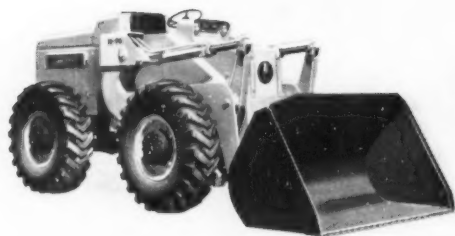
TRANSLOT

Cannelton Sewer Pipe Co.
Cannelton, Ind.



BOSCO

Bowerston Shale Co.
Bowerston, Ohio



It COSTS LESS
To BUY the BEST

NEW MODEL H-90

GIVES YOU MORE VALUE FOR YOUR MONEY... MORE CARRY CAPACITY... MORE PERFORMANCE... MORE DEPENDABILITY

When it comes to investing money in equipment which must earn money, you can't afford anything but the best. Thousands of owners have found this to be true of the famous HO "PAY-LOADER"... thousands more will find it even more so in the new, improved Model H-90.

Full 9,000-lb. Carry Capacity

You can lift loads up to 15,000-lbs., but you can CARRY LOADS up to 9,000-lbs., which means you can use buckets ranging up to almost 4 cu. yds., depending on the weight of the material. Because the bucket tips back 44° at ground level, you can carry 9,000-lb. loads closer to the machine and lower with better balance, stability, speed and less spillage. All excess "dead weight" has been eliminated and through balanced design, the H-90 can carry more pounds in the bucket than comparable machines weighing as much as 3,000-lbs. more.

More Powerful Breakout

A breakout force of 21,000-lbs., almost the entire weight of the machine, can be applied to the cutting edge of the bucket through unique pry-out pads. This enables you to get full bucket loads in the toughest digging.

Choice of Four Engines

The new H-90 gives you a choice of two gasoline engines and two diesel engines: either the 125 H.P. Hercules WXLC-3 or the 134 H.P. I-H

U-450 in the gasoline, and the 122 H.P. Cummins JN-6-B1 or the 126 H.P. G.M.C. 4-71 in the diesel.

Extra Heavy-Duty Planetary Axles

Because tractor-shovels of this size and capacity are subjected to greater than average stresses and strains, the H-90 "PAYLOADER" planetary axles are special, extra heavy-duty type with power transfer differentials.

Full Protection for Long Life

The brakes of the front wheels are sealed to prevent scoring and glazing by foreign matter. Large oil-bath air filters and cartridge-type oil filter protect the engine. Two cartridge-type oil filters protect the hydraulic system oil and the transmission-torque converter oil.

Easy, Full-Power Operation

Power-shift transmission with three speeds forward and reverse, plus twin-cylinder power-steer and 4-wheel power brakes, assure fast operation with minimum operator effort... promote a high production rate the full shift.

More Attachments... More Uses

The widest choice of attachments are available, including these exclusive ones: Drott 4-in-1 bucket, Superior side-boom, Galion vibratory compactor, Ram black-top spreader... also blower, "V" and blade plows, angling back filler, scarifier, winch and others.

THE FRANK G. HOUGH CO.

761 Sunnyside Ave., Libertyville, Ill.

Send data on new Model H-90 PAYLOADER

Name _____
Title _____
Company _____
Street _____
City _____ State _____

1-8-1

HOUGH®



THE FRANK G. HOUGH CO.

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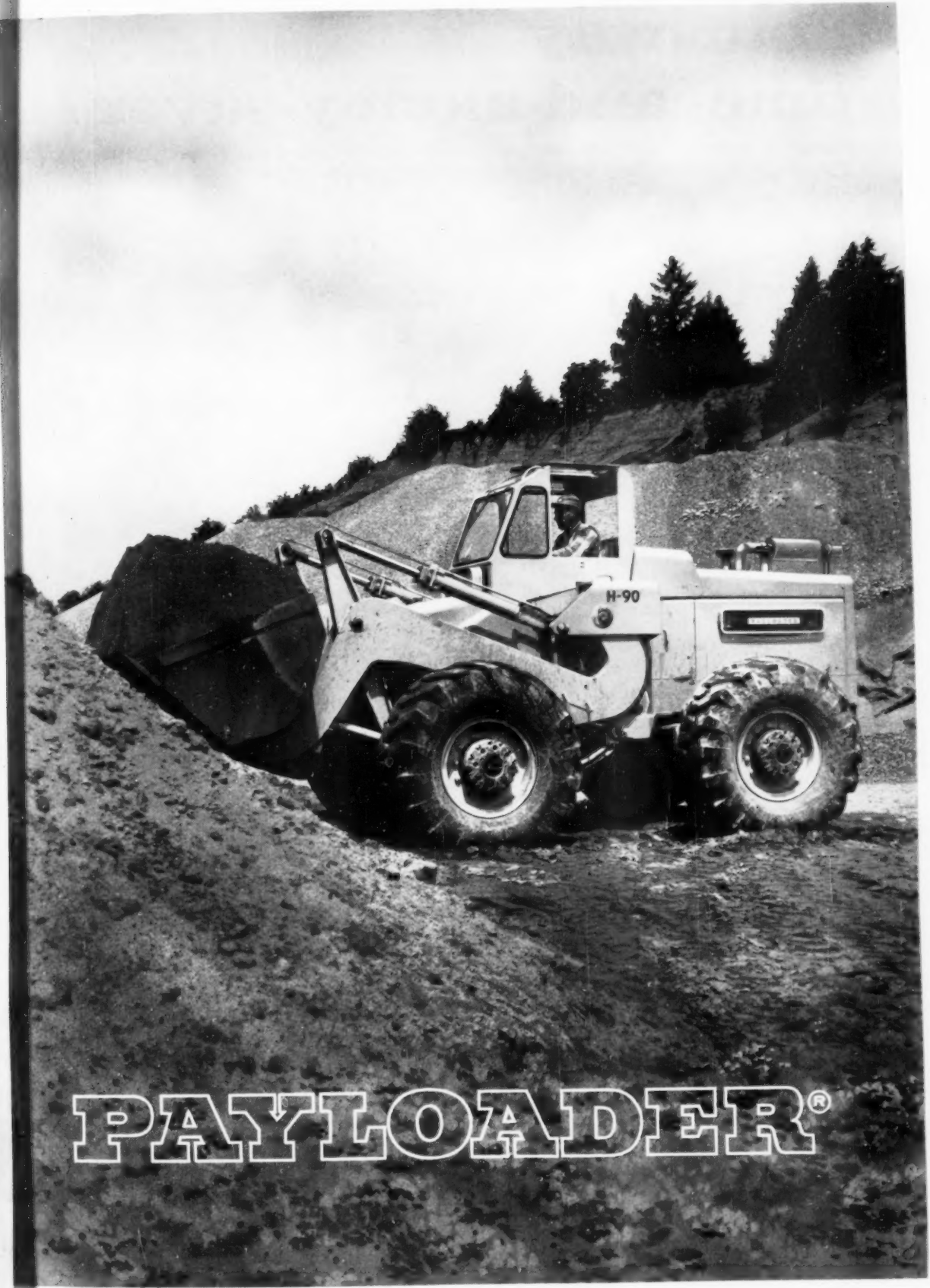
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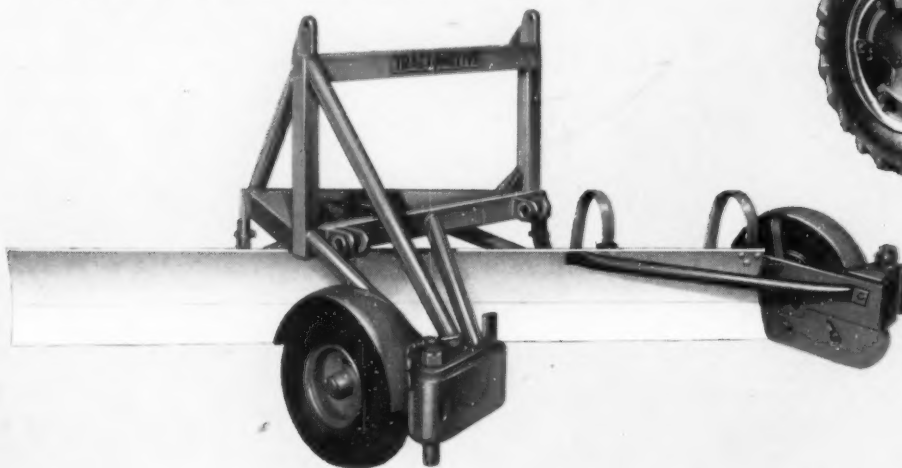


Four-way time- and money-saver

ONE Load trucks, clean road rubble, stockpile with your D, too. The handy $\frac{5}{8}$ -yd bucket is interchangeable with the maintainer.

TWO Shoulder maintainer rebuilds shoulders, establishes good drainage—then maintains them with one safe, off-the-road pass.

As a windrow eliminator, this timesaving attachment feathers windrows while patrolling. Leaves a clean trail on only one pass.



ROLL-AWAY is an Allis-Chalmers trademark.



Springtime is D-time all over America . . . the time when a Model D motor grader can help you most. This year, when spring uncovers winter-worn roads, be sure you're ready with a four-way, special purpose Model D.

See a Model D before you write bid specs

move ahead with **ALLIS-CHALMERS**.....

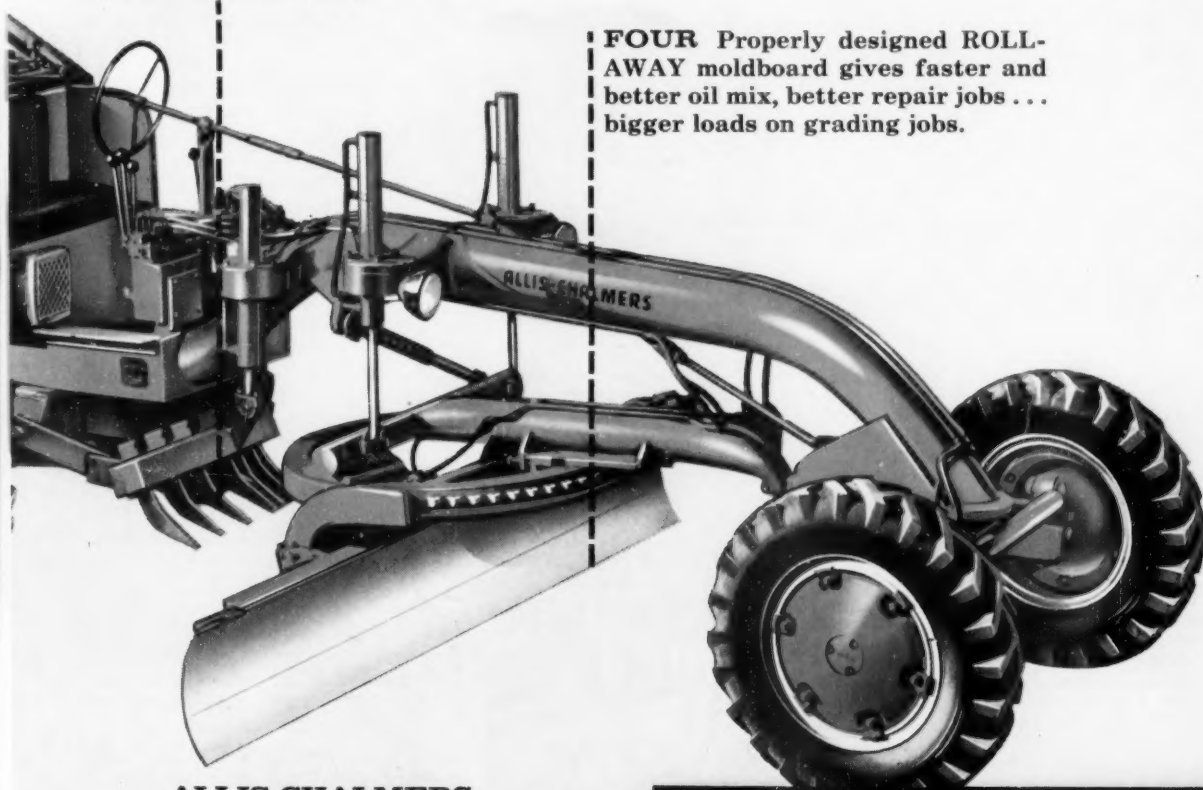
**YOU CAN DO MORE SPRING ROAD MAINTENANCE WORK
ON TIME AND AT LOWER COST WITH AN ALLIS-CHALMERS
MODEL D THAN WITH ANY OTHER GRADER**

Worried about winter's leftover frost boils, potholes, washouts? Here's the solution—an Allis-Chalmers Model D. More than just a grader, the D mounts enough attachments to make it a "one-man road gang."

And best yet—the D costs so little you can own two or three for the cost of one "big" grader. Spotted strategically your D's then cover more ground—help you get the jump on spring work and stay ahead all year.

THREE Unique midship mounting gives extra down-force, helps retain front-end steer-ability.

FOUR Properly designed ROLL-AWAY moldboard gives faster and better oil mix, better repair jobs ... bigger loads on grading jobs.



**ALLIS-CHALMERS
MODEL D MOTOR GRADER**

for new road machinery. There isn't another grader that can do as many jobs for you at such low cost. Ask your Allis-Chalmers dealer to prove it with a demonstration—on your own roads. *Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.*



4 Model D graders available
58-hp gasoline engine—8,800 to 11,450 lb
diesel engine also available

power for a growing world



Giant V-plow on A-W grader knives through crusted snow to clear 9-ft. 2-in. swath. Snow wing moves deeply piled snow farther to side or can be used for extra-wide blade path.

Win winter snow removal battles with V-plow and wing-equipped Austin-Western

No truck or grader can match the snow-fighting ability of an Austin-Western equipped with giant V-plow and wing. The secret lies in Austin-Western's exclusive all-wheel drive and steering. Front end driving power provides vital pull-push action for deep plowing . . . rear steering lets you resist powerful sidethrust when winging or widening.

Walks out of drifts, ditches

Rear steer also lets you work short radius curves like street corners, without backing, steer closer around obstructions like hydrants and poles. From users everywhere you hear things like this: "It's almost impossible to get an A-W stuck. You just steer the rear end and walk both ends diagonally out of drifts or ditches. Our A-W graders often rescue 4-wheel drive truck plows and other graders."

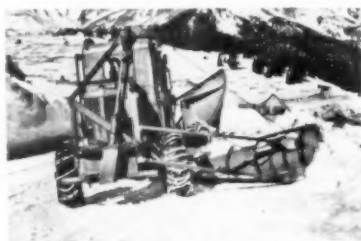
The operator never has to leave his warm, weathertight cab. Entire snow fighting operation can be hydraulically controlled from cab in bitterest cold.

Keep streets open

A-W graders are quality built for high

performance under the most rugged conditions. They can be depended upon to stay on the job, without big downtime or maintenance problems, even during punishing month-long, round-the-clock "blitz" type snow removal operations. A-W graders will keep your streets and highways open!

This year win the battle against traffic-paralyzing snow. Learn all about the A-W grader with giant V-plow and wing. See your local Austin-Western distributor now or write to us.



Rear steer counteracts side draft and adds the maneuverability so essential where the "going is toughest."

Austin Western



CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes



Thomas Calvin Robbins is Director of the Mississippi State Highway Department. He began his career with the Highway Department as a fledgling engineer in the summer of 1923, when the state had little to boast of in the way of highways. Less than thirty miles of the state system were paved, and the budget for planning and building future highways was insignificant. In the intervening years, Mr. Robbins has helped build a highway network that compares favorably with any state. As Director for the past eight years, he has headed an accelerated program of construction on Primary and Secondary routes; and since the Federal Aid Highway Act of 1956, has put Mississippi into an enviable position with the Interstate System.

A native of Jones County, Mississippi, Mr. Robbins received his degree in Civil Engineering from Mississippi State. He went to work for the State Highway Department shortly after his graduation, and most of his career has been spent in this field. Starting as a Draftsman, he subsequently served as an Instrumentman, Assistant Project Engineer, Project Engineer, District Engineer, and finally as Director—a position he won on the basis of an exceptional record of highway engineering and administration. The only break in his long career of highway work was shortly after World War II, when he joined Fernwood Industries, heading the Engineering Department.

Today from his office across the street from the State Capitol he directs a construction and maintenance operation which this year has an all-time record budget of \$87,000,000. Pictures of his wife and ten-year-old son, Tommy, occupy prominent places on his desk, and maps of the state highway system adorn the wall behind him.

Mr. Robbins is a member of the Executive Committee of the American Association of State Highway Officials. He is a member of Tau Beta Pi, a Rotarian and a member of the Jackson country club. He and his family are Presbyterians.

6,600 reasons why Greensburg depends on **Bailey!**

Every day the 6,600 residents of Greensburg, Indiana, use up to 1,000,000 gallons of water. Three Bailey Filter Operating Consoles control and indicate the flow of this water through the rapid sand filters. Space for a fourth console has been provided for future expansion.



Engineers: Moore & Heger

With population growth and industrial expansion comes the opportunity to adopt newer, more economical and more scientific methods of water handling.

Many cities, like Greensburg, are installing Bailey Instrument and Control Systems. Because Bailey can furnish *complete* control systems...made up of *standardized* components...that not only do a better job,

but can easily be *expanded* to meet future needs. Engineers, water superintendents and city officials themselves will tell you that Bailey electric and pneumatic telemetering and control systems are outstandingly reliable and economical, attractive, and easy to maintain.

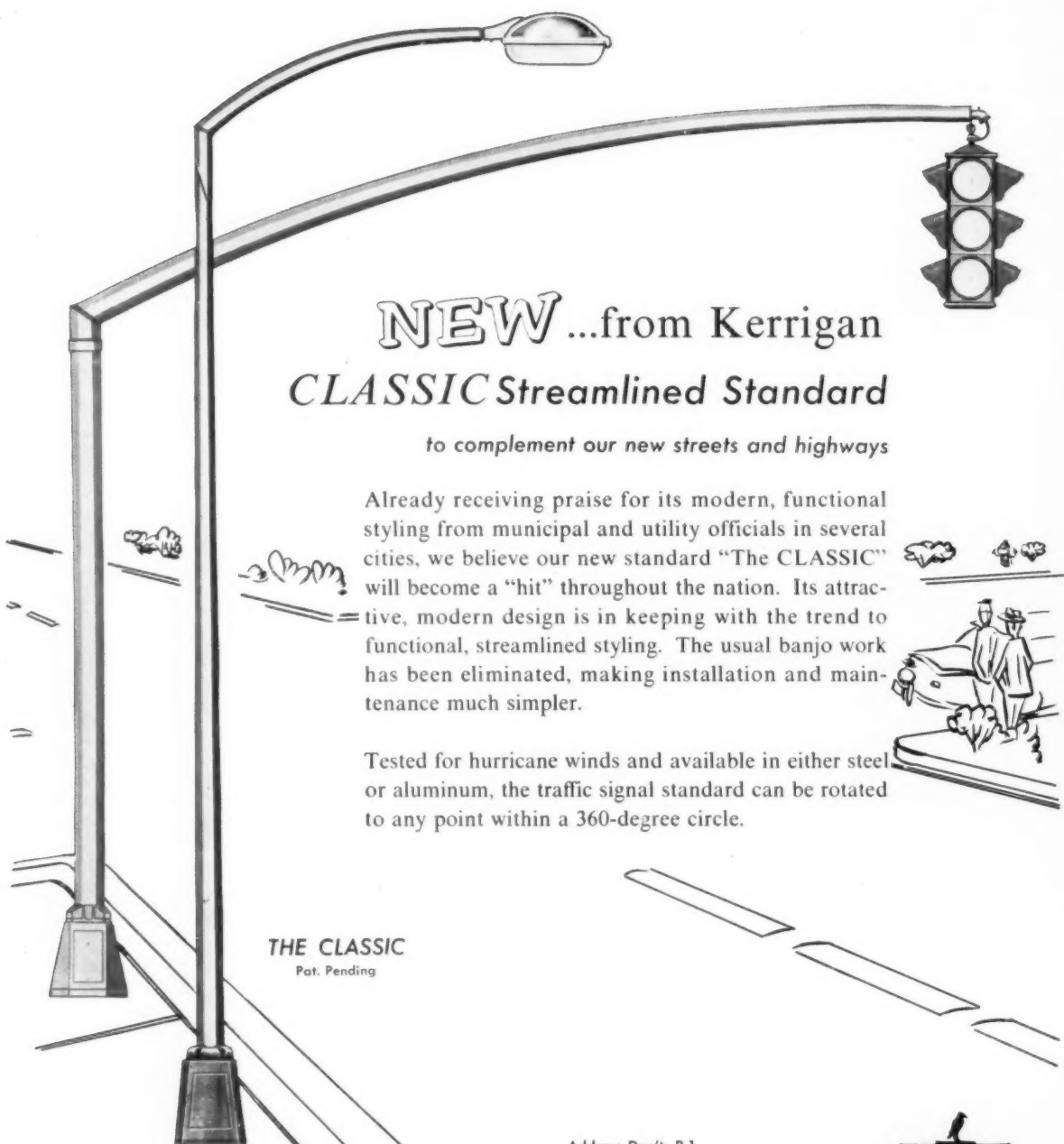
Ask your qualified Bailey Engineer for recommendations.

W-5

WATER & WASTE TREATMENT DIVISION **BAILEY METER COMPANY**

1055 IVANHOE ROAD • CLEVELAND 10, OHIO
In Canada—Bailey Meter Company Limited, Montreal





NEW ...from Kerrigan CLASSIC Streamlined Standard

to complement our new streets and highways

Already receiving praise for its modern, functional styling from municipal and utility officials in several cities, we believe our new standard "The CLASSIC" will become a "hit" throughout the nation. Its attractive, modern design is in keeping with the trend to functional, streamlined styling. The usual banjo work has been eliminated, making installation and maintenance much simpler.

Tested for hurricane winds and available in either steel or aluminum, the traffic signal standard can be rotated to any point within a 360-degree circle.

THE CLASSIC
Pat. Pending

Address Dep't. P-1

For further information on the brand new "CLASSIC", write, wire or phone CHapel 2-4262.

Weldforged LIGHTING STANDARD DIVISION

KERRIGAN IRON WORKS, INC.

Nashville, Tennessee



improving a superior product

American Concrete Cylinder Pipe has long been established as one of the outstanding developments in the field of pressure transmission of water. This superior design combines the physical properties of steel with the structural and protective properties of concrete — producing a pipe of great strength and long life. Important transmission lines of American Concrete Cylinder Pipe are today serving most of the major cities and population centers in the western United States.

Through the years, continuing research has led to improved features in the manufacturing process. These features enrich the alkaline environment surrounding the steel components, which environment is so necessary to the continuing and everlasting protection that well-made concrete gives to this high quality pressure pipe.

Specify these plus-factors featured by American — where research, development and quality control are always striving to make high quality products even better.

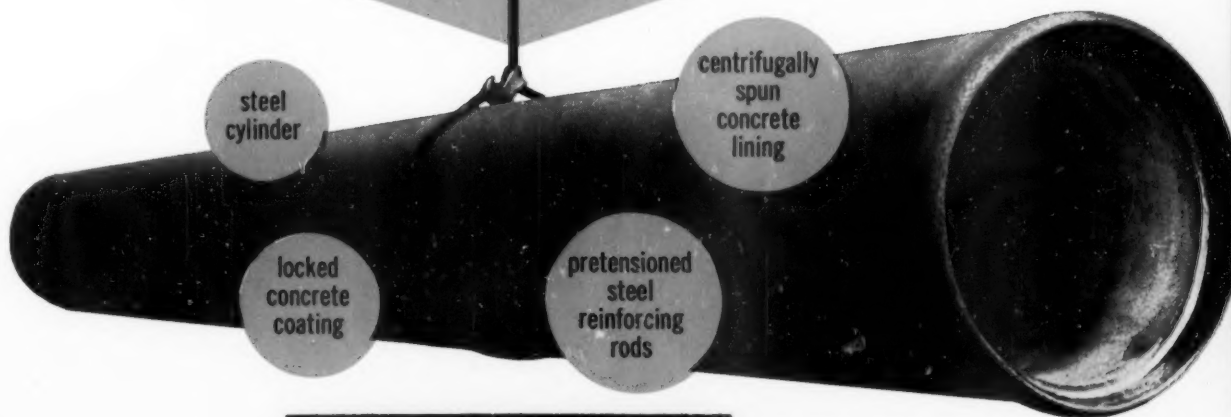
American Concrete Cylinder Pipe is available in a diameter range of 12" through 60" I.D. and in standard lengths of 32 feet.



Rich cement wash applied to steel reinforcing rod just before it is wound under measured tension and with accurate spacing around concrete lined cylinder provides positive assurance of a highly alkaline environment between surfaces of cylinder and circumferential reinforcement.



An additional rich cement wash over the entire outer surface of the pretensioned steel cylinder before application of the pipe's dense mortar coating assures maximum alkaline environment where it is most needed.



Los Angeles: 4635 Firestone Blvd.,
South Gate, Calif., LOrain 4-2511

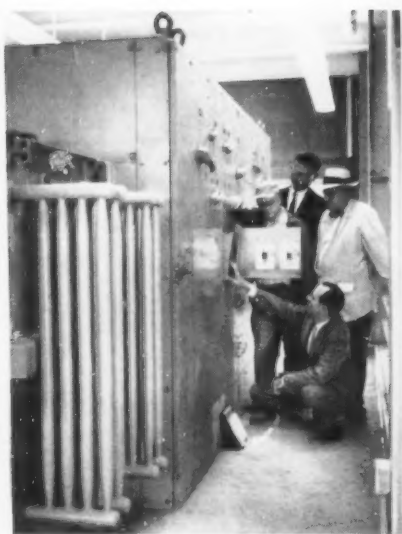
Hayward: P.O. Box 630—JEfferson 7-2072

San Diego: P.O. Box 13—CYpress 6-6166

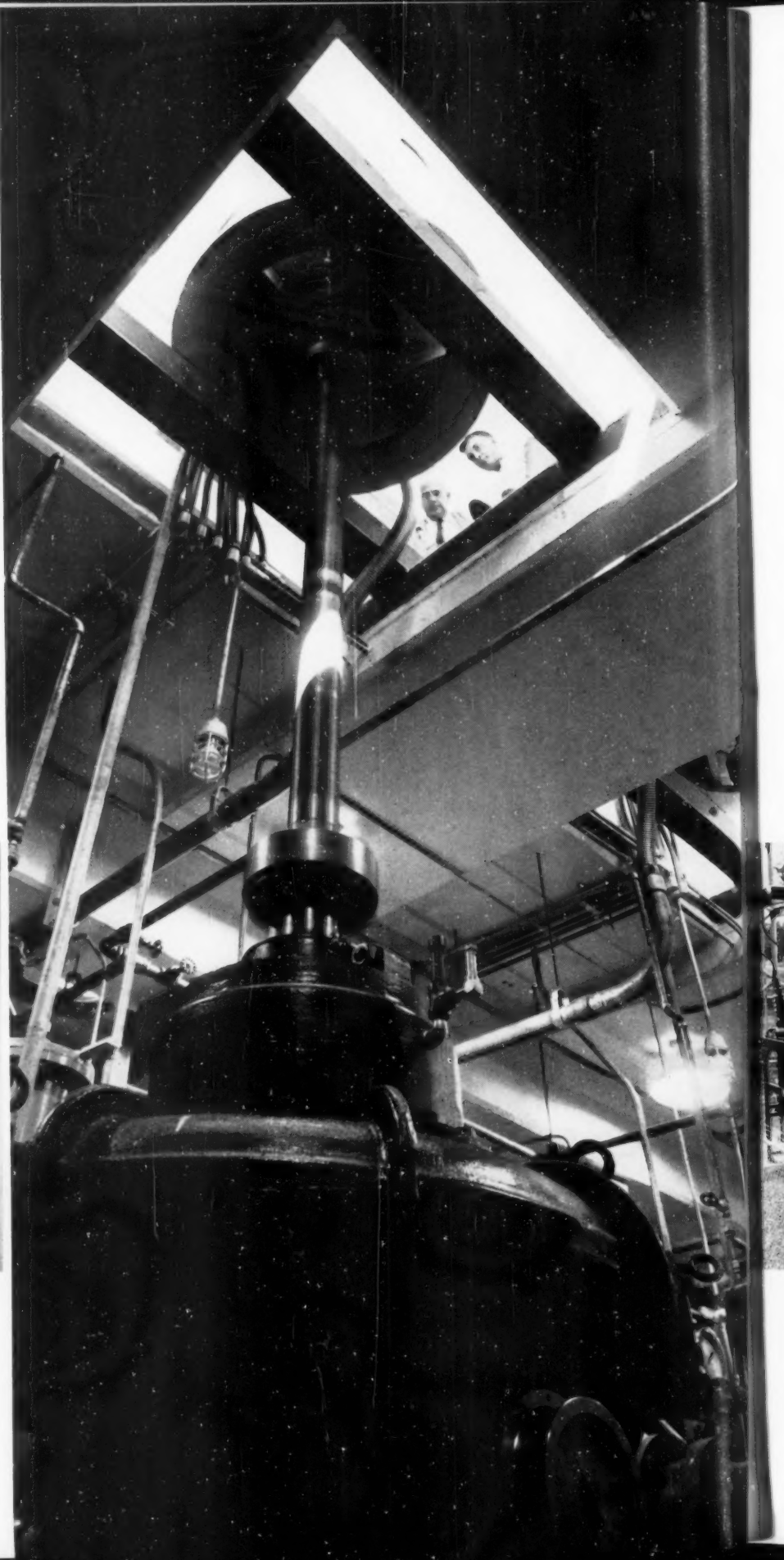
Phoenix: 2025 South 7th St.—ALpine 2-1413

Portland: 518 N.E. Columbia Blvd.—BUtler 5-2531

View from pump floor in Oswego, New York, pumping station showing one of main pumps being driven by Westinghouse 300-hp vertical synchronous motor above.



Robert B. Stannard, Resident Engineer for Nussbaumer, Clarke and Velzy, Consulting Engineers; Karr Parker, Jr., Buffalo Electric Co.; Kenneth D. Jensen, Superintendent, Department of Water, Oswego; and M. B. Trimble, Westinghouse Construction Sales Engineer, discuss "tilt-out, lock-out" feature of the control center. Westinghouse double-ended control power center has 300-kva In-terteen® transformer at each end.



Oswego water pumping station Powers-Up to attract new industries

The modernization and expansion program of the Department of Water, Oswego, N. Y., provides an interesting example of building today for tomorrow's needs. While planning for today, Oswego's Water Board recognized that a good water supply is an indispensable commodity in attracting new industry to the area. By Powering-Up electrically, their new pumping station has electrical capacity five times present demand to allow for future growth.

Present demands for water are approximately 10 million gallons per day. Installed pumping capacity is capable of providing more than 20 million gallons per day. In addition, provision has been made to increase capacity to 35 million gallons per day when required by future demands.

The new pumping station is supplied with lake water from an intake tunnel which extends through solid rock for a distance of 6250 feet into Lake Ontario. This tunnel intake averages eight feet in diameter and is capable of conveying 128 million gallons of water per day.

Electrical power for the station is available from two separate sources—one direct from the Oswego Steam Station and the other from the Niagara-Mohawk Varick Station. The complete electric distribution system, as furnished by Westinghouse, provides for all anticipated future expansion of the pumping station.

Powering-Up electrically for future growth can offer important advantages to you. For further information, call the Westinghouse electrical engineer nearest you, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-94119

Owner: Department of Water, Oswego, N. Y.

Consulting Engineers:

Nussbaumer, Clarke and Velzy

General Contractor: McElwee-Courbis Const. Co.

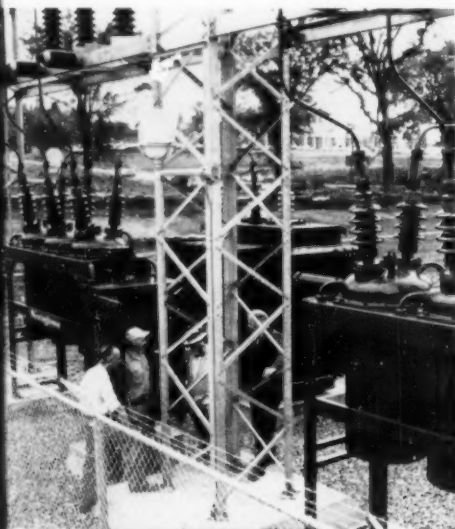
Electrical Subcontractor: Snyder and Mackin, Inc.

Westinghouse Distributor: Buffalo Electric Co., Inc.

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Westinghouse

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CBS TV MONDAYS

S Over 250 Pages Westinghouse Data in Sweet's Construction File.



Leo J. Landrigan, Superintendent, Oswego Pumping Station; Richard C. Mansfield, Foreman for Snyder and Mackin, Electrical Contractors; Kenneth D. Jensen; and Charles T. Hansen, Westinghouse Sales Engineer, at outdoor substation which serves new Oswego pumping facility. Two Westinghouse 2000-kva power transformers and two Westinghouse 34.5-kv oil circuit breakers are included in this substation.



Main floor view in pumping station shows four Westinghouse vertical synchronous pump motors with the glass enclosed control room in background. The mezzanine floor above is occupied by Westinghouse 2300-v, heavy-duty, metal-clad switchgear, using Type DH air circuit breakers.



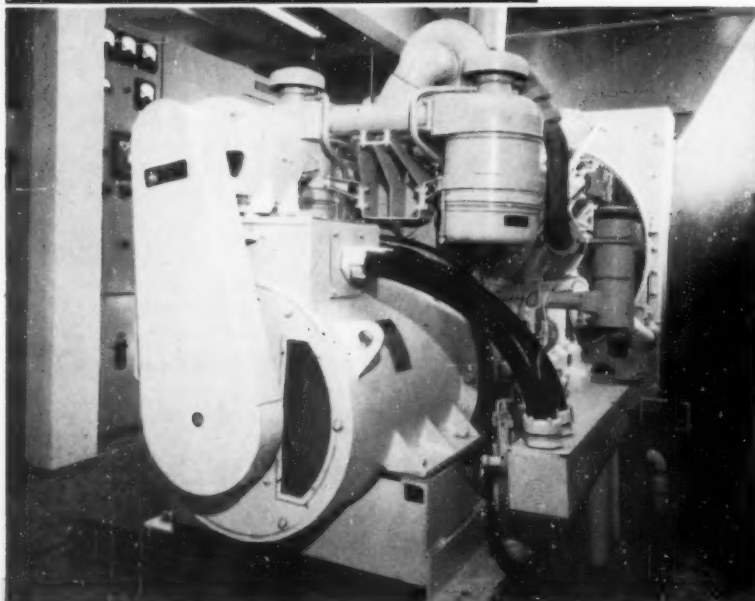
Another view of main floor shows reverse side of control room and, on the mezzanine, Westinghouse double-ended control power center. Floor openings in foreground, not shown, have been provided for the installation of four additional raw water pumping units when filter plant is added.

engine power

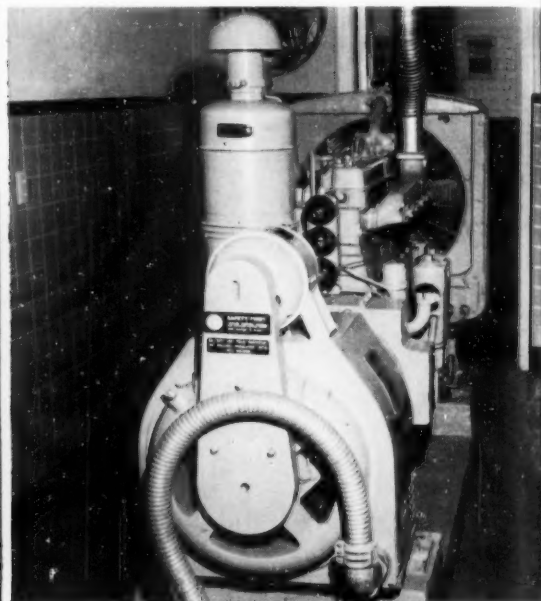
BY CATERPILLAR

WHY YOU CAN COUNT ON CAT ENGINES

For sure protection against power failure, install a compact Cat Electric Set ready to start automatically in seconds!



City of Orlando, Florida, relies for protection on this and another Cat D397 Electric Set (350 KW continuous duty) in its sewage treatment plant. The system serves a population of 65,000 and pumps an average of 8,000,000 gallons a day.



Avon by the Sea, New Jersey, depends on this Cat D318 Electric Set (60 KW continuous duty) as an emergency unit in its sewage plant. Treatment tank capacity is 11,526 gallons. Equipment can handle two 1,000-gallon-per-minute pumps.

Power failure is *no problem* when you have a Caterpillar Electric Set standing by. Each of these modern, heavy-duty units can be equipped with automatic start-stop controls which require no operating personnel. If power fails, they assume the load in seconds and continue as long as needed.

Communities large, medium-sized and small rely on Caterpillar emergency power for positive protection. For example, two Cat D397 Electric Sets serve in this capacity in the sewage disposal plant in Orlando, Florida. Superintendent R. E. Simon says: "They are automatic and it is only an instant before they take over in case of failure."

Are you protected against power failure?

If you aren't, there's no time like *now* to look into the advantages of modern, heavy-duty Cat Diesel Electric Sets. They range in capacity from 30 to 375 KW (standby rating). They are available with three starting systems—air, gasoline and electric. Automatic start-stop controls also are available for each Caterpillar Electric Set to automatically start the engine seconds after power fails and to stop it when power returns. They're so compact they require little space. And they're easy to service!

Ask your Caterpillar Dealer to help you select the emergency unit that best meets your needs!

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

■ Cut-In Sleeve and Valve installed in main



MUELLER® cut-in sleeves and valves

*Install needed control valves
without breaking pipe joints!*

■ New control valves can be added and old valves replaced quickly with Mueller Cut-In Sleeves and Valves. Only a minimum of excavation is necessary. You don't have to uncover several lengths of pipe so that pipe joints may be broken. You can install the valve right where you want it — anywhere on the pipe length.

Special mechanical joints on both sleeve and valve permit one Cut-In Sleeve and Valve of a nominal size to be used on any cast iron pipe regularly found in water distribution systems by using the proper end gaskets.

Mueller Cut-In Valves have the same quality features as the Mueller AWWA Gate Valve — including the 4-point-contact wedging mechanism. "O" ring stem seals or conventional packing are optional. Indicator post type cut-in valves are also available. Sizes 4", 6", 8", 10" and 12".

See your Mueller Representative or write direct for full details.



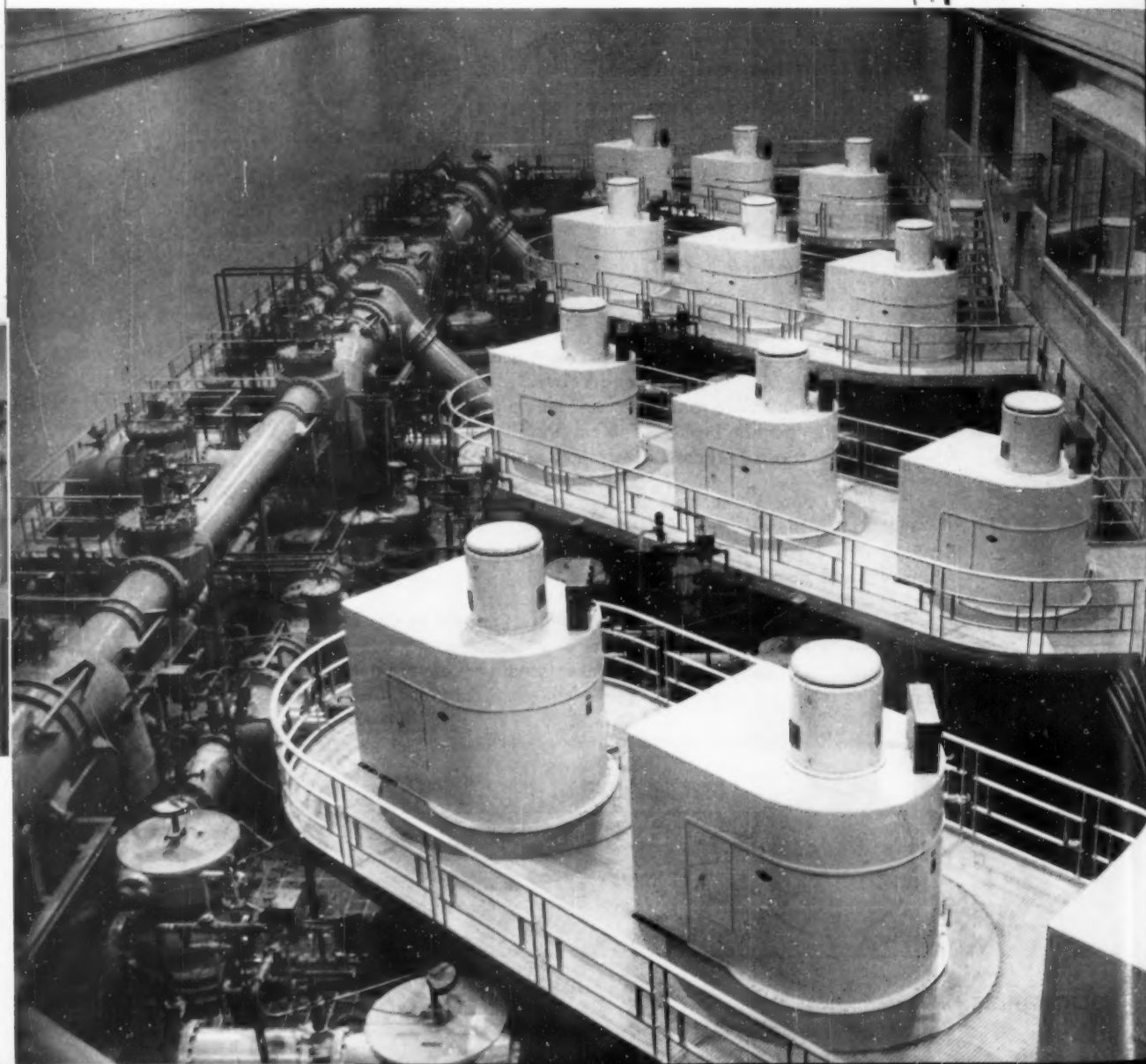
MUELLER CO.

DECATUR, ILL.

Representatives in: Australia, Canada, Denmark, France, Germany, Italy, Japan, Korea, Mexico, Norway, Sweden, Switzerland, Taiwan, Thailand, U.S.A., U.K., Venezuela, West Germany, Yugoslavia, Zaire

CHAPMAN

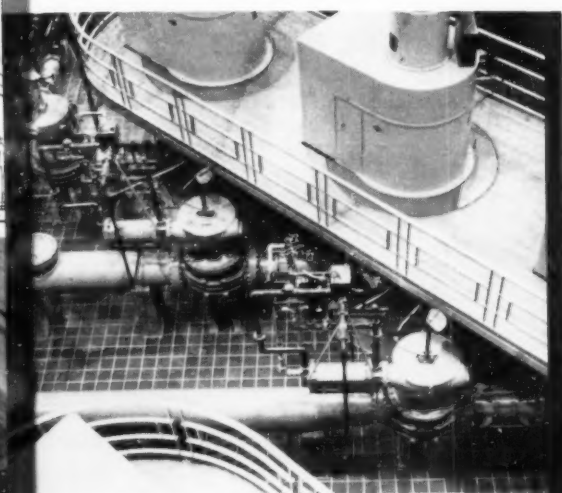
*plays an important part for
an important service
to the Nation's Capital*



Washington, D. C., Arlington County, Virginia and parts of Fairfax County, Virginia have unique, efficient, and progressive means of providing more effective water service for public health, convenience and fire protection. The Supply System was designed, built and is operated by the Corps of Engineers, United States Army. The Distribution System in the national capital is operated by The Commissioners, District of Columbia, Department of Sanitary Engineering. More than one million persons are being served and they are being served well... 153,157,000 gallons per day.

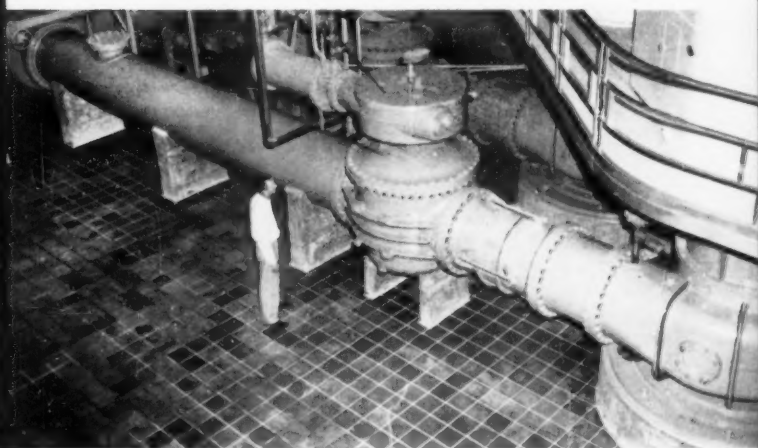
Big and modern as it is, the Water System of The District of Columbia is still expanding. They have already invested \$85,323,559 in this public service and more funds have been appropriated for extra facilities. These include construction of additional filters, a new chemical building, and an added two story flocculation-sedimentation basin.

The source of water for the entire system is the Potomac River. Water is pumped through miles of conduits to the McMillan, Georgetown and Dalecarlia reservoirs for storage and subsequent filtration and treatment. Pumping stations are operated at McMillan, Dalecarlia, Bryant Street, Reno and Anacosta. Filtration plants are at McMillan and Dalecarlia. And throughout the entire system you'll find countless Chapman Valves. Chapman has been meeting the demands of this modern system for a number of years. The United States Army Corps of Engineers and the District of Columbia, Department of Sanitary Engineering insist that their valves meet every modern requirement... requirements that involve operation, size, pressure, stress and flow.



Interior views of the completely air-conditioned Dalecarlia Pumping Station showing some of the many Chapman Cone Type Valves used largely as protection from reversal on power failure of pumps and piping. The Dalecarlia Hydroelectric Station utilizes surplus water for generation of electrical energy, thereby reducing pumping power costs. The hydro-turbines may be converted to raw-water pumps, reversing the direction of water flow.

Right, Chapman 30-inch discharge cone valve, one of the countless Chapman Valves used throughout this system.

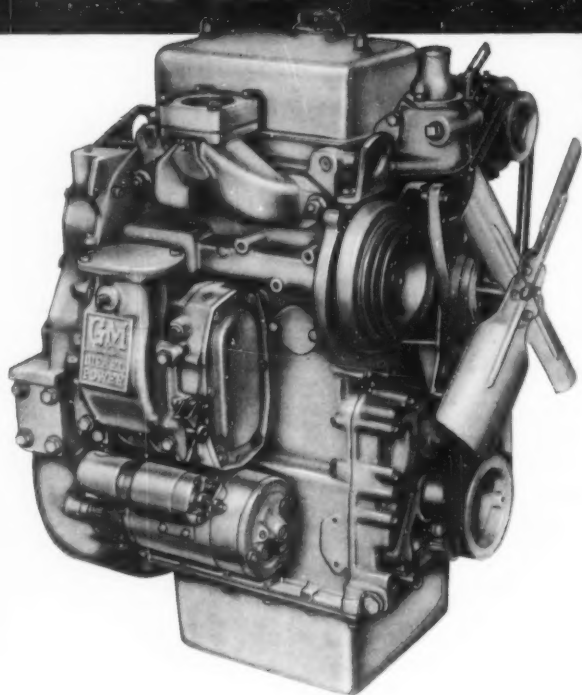


The **CHAPMAN** Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS

For more than 75 aggressive years, Chapman has been producing valves that meet every modern requirement. Chapman has the engineers, the metallurgists, the foundries, the manufacturing and testing facilities to meet the higher-pressure, higher-temperature demands of both today and tomorrow. At Chapman, there is always something new. It will pay you to talk with one of our engineers and let him bring you up to the instant. Write to us and he'll call at your convenience.

MORE BIG NEWS FROM



Now a **DIESEL** Engine for JOHN DEERE 440 TRACTORS

**Bringing you every DIESEL advantage
PLUS 10% MORE POWER**

Here, power-matched to John Deere "440" Crawlers and Wheel Tractors, is a modern Diesel power plant that means even greater savings for you on time and fuel. Equipped with this famous "Jimmy" Diesel engine, John Deere "440" Tractors not only provide *more* power—10 per cent more than previous tractors in the line—they also give you the *faster* response of high-compression, high-torque Diesel performance.

In addition, the "fire insurance" of Diesel fuel opens up new construction and materials-handling jobs to the John Deere "440" in mines, dockyards, and other confined areas.

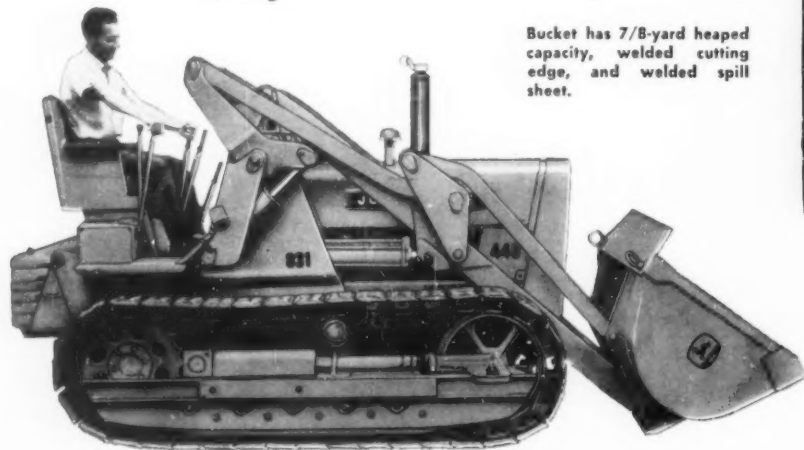
Whatever your reasons for preferring Diesel power, act now—cash in on modern Diesel advantages with a John Deere "440" Crawler or Wheel Tractor and matched working equipment.

A *New* answer to speedy, low-cost loading... **THE JOHN DEERE 831 LOADER**

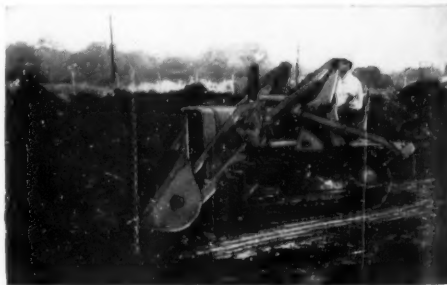
Take your choice of John Deere gasoline or Diesel power, but pick the new John Deere 831 Loader for a *new low* in earth-moving costs! Rugged construction, plus the husky hydraulic system of the "440," provides extra pry-out pressure and lifting ability that greatly increase daily work capacity.

Check into the new John Deere 831 Crawler-Loader now—start setting new records for low-cost earth moving.

Bucket has 7/8-yard heaped capacity, welded cutting edge, and welded spill sheet.



When bucket is dumped from full-height position, it returns to the ideal 9-degree digging angle by use of the boom control only.



JOHN DEERE

Introducing the FIRST 5-POSITION BACKHOE in the Field... THE *New* JOHN DEERE No. 51

One man with a wrench can set the boom on this John Deere 51 Backhoe in any of five mounting positions—in 15 minutes or less. End position at right or left speeds flush-digging along buildings. End mounted, the hoe folds against tractor to make a compact, well-balanced unit for transporting.



Ground-level reach: 20 feet, 9 inches. Working depth: 13 feet, 6 inches. Dumping height: 11 feet, 9 inches. Boom travel: 180 degrees.

PLUS

...a brand *New* center-position BACKHOE... THE JOHN DEERE No. 50



Working depth of the John Deere 50 Backhoe is 13 feet, 6 inches. Bucket has side-cutting edges and replaceable teeth.

Here's reach and power to tackle any trenching job! Center-mounted boom has a 20-foot, 3-inch reach at ground level, swings smoothly through a 205-degree arc by hydraulic power. Two control levers do the job, while operator sits in comfort. Same hydraulic system that operates backhoe also powers loader.



Completely Engineered for Industry

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Please send free information on ☐ "440" Diesel Crawlers ☐ "440" Diesel Wheel Tractors ☐ 831 Loader ☐ 50 Backhoe ☐ 51 Backhoe.

Name _____
Firm _____
Address _____
City _____
State _____

State _____

"151,000 MILES WITHOUT A MAJOR OVERHAUL!"

*says Clarence F. Guthrie
Canonsburg, Pa.*



Every Ford has
SAFETY GLASS
in every window

"Ford's 332-cu. in. V-8 is the hottest thing on the road for its size!"

"Our fourteen Ford trucks all have exceptional durability records. Several '55 T-800 dumps, grossing 48,000 lb., have over 200,000 miles on 'em. They went an average of 150,000 miles before we touched the engine. And for power and performance, too, the Ford 332 engine is the hottest thing on the road for its size.

"Ford's better visibility, handling ease and power steering are big factors in our excellent highway safety record. We've had many million-mile accident-free years with our Ford fleet.

"In addition to our sand and gravel business, we have ten Ford F- and C-800 tractors that make long, over-the-road trips hauling limestone one way and steel on the way back.

"On these trips parts availability is very important. Ford Dealers are about everywhere, and they all stock parts. We never get delayed waiting for Ford parts."

Go FORD-WARD for savings with '59 Ford Trucks!

Whatever your job . . . wherever you do it—you'll find Ford Heavies and Extra Heavies are engineered and built to do it better! And the '59 improvements in these models will bring still more benefits to your operation.

Greater operating economy with new, faster rear axle ratios and wider choice of transmissions.

Higher payloads and longer axle life with new, higher-capacity front and rear axle options for most models.

Factory installed tractor package custom-fitted to Ford trucks for safer, more dependable braking.

More efficient parking brake of the internal expanding type has approximately 50% greater stopping and holding ability, requires less than half the operating effort needed for the previously used type.

Yes, the new '59 Ford trucks are here to take you *Ford-ward* for savings, *Ford-ward* for modern style and stamina.

See your Ford Dealer today!



NEW '59 FORD F-600 DUMP carries a maximum GVW rating of 19,500 lb. Now available with optional 6000-lb. front axle for greater capacity, longer life.

FORD TRUCKS COST LESS

LESS TO OWN...LESS TO RUN...LAST LONGER, TOO!

EQUIPMENT and MATERIALS

FOR
YOUR

PUBLIC WORKS PROGRAM

NEW LISTINGS

Valuable Model Catalog on Reo Trucks

166. Reo engine specifications and truck models are covered in 28-page catalog from Reo Div., The White Motor Co., Lansing, Mich. Check the reply card for your copy.

Sewage Ejector and Pneumatic Lift Station

176. Centri-Lift sewage ejectors for lift stations are described in a manual available from Schmieg Industries Inc., P.O. Box 4701, Detroit 34, Mich. Check the reply card for descriptions, specifications and typical drawings.

Complete Line of Wheel Tractors in 6 Power Sizes



179. A 16-page catalog CR-1374-H, that describes the 6 IHC wheel tractors from 12 to 72.5 hp, is available from the Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Check the reply card for special features and specifications for each of these 6 tractors, and a listing of all attachments available.

Engineering Data on Double Suction Pumps

181. Bulletin #251 features Warren type DMB and DB horizontal split case, double suction centrifugal pumps for general water service. Check the reply card or write Warren Pumps, Inc., Warren, Mass., for detailed specifications and selection table.

Portable Rotary Air Compressor

187. General specifications on the LeRoi 365 rotary compressor are covered in bulletin available from the Sales Promotion Dept., LeRoi Div., Westinghouse Air Brake Co., Milwaukee, Wis. Check the reply card.

Plastic Pipe for Municipal Water Systems

192. Plastic pipe for sprinkler systems, municipal service lines, domestic water wells and swimming pools is described in literature from Southwestern Plastic Pipe Co., P. O. Box 117, Mineral Wells, Tex. Check the reply card.

General Principles of Mechanical Dust Collectors

195. Bulletin MSP-124A describes the Hagan Aerostatic dust collector that has selective particle acceleration and honeycomb design. Check the reply card or write Hagan Chemicals & Controls, Inc., Hagan Building, Pittsburgh 30, Penna., for full details.

Hydraulic Cutter Will Cut Water Pipe

205. Water pipe through 12 ins. can be easily cut with this Wheeler cutter. Check the reply card or write The Wheeler Mfg. Corp., P. O. Box 688, Ashtabula, Ohio, for models and specifications.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Centrifugal Pumps for Liquids Containing Solids, Air or Gases

202. Ingersoll-Rand centrifugal pumps that are non-vapor-binding, self-venting, non-clogging and self-regulating are covered in literature from Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. Check the reply card for full specifications and detailed drawings.

Data on Static and Vibratory Rollers

203. Literature on a one-ton static type roller and a two-ton vibrating type that fully describes the units, complete with specifications is available from Rosco Mfg. Co., 3118 Snelling Ave., South, Minneapolis 6, Minn. Check the reply card.

Manual on All Steel Swimming Pools

210. Municipal and community swimming pools are covered in manual available from Koven Steel Swimming Pools, Inc., 90 East Dickerson St., Dover, N. J. Check the reply card for data on location, design, drainage and facilities.

Fresh Water Unlimited By Sea Water Distilling Plants

216. Description and principle of sea water distilling plants are covered in a well illustrated catalog from The Maxim Silencer Co., 85 Homestead Ave., Hartford, Conn. Charts, graphs and color drawings are included. Check the card.

Asplundh Trim Lift, New Aerial Device

217. Aerial device incorporates the Spiral-loy, which completely and permanently insulates the operator from the ground while in the basket. Check the reply card or write Asplundh Chipper Co., 501 York Road, Jenkintown, Penna., for specifications.

File Your Plans to Save Time and Money

219. Glider blue print racks save in time and work by vertically retaining plans. Check the reply card or write Momar Industries, 4323 W. 32nd St., Chicago 23, Ill., for rack sizes and capacities.

M-B Hy-Lite Reflective Beads

224. M-B Hy-Lite beads give greater impact to any type of highway and municipal sign. Literature and details may be obtained by checking the reply card or writing M-B Corp., New Holstein, Wis.

Data on Rain and Snow Gage

225. Universal recording rain gage measures and records all forms of precipitation. Description of unit, dimensions and capacities are covered in literature from Universal Instrument Co., 3809-11 Bunker Hill Rd., Brentwood, Md., or by checking the reply card.

Bulletin on Sawed Excavations

233. Four-page bulletin from The Clipper Mfg. Co., 2800 Warwick, Kansas City 8, Mo., utilizes on-the-job photographs to show many instances where the use of concrete saws for controlling pavement breakage is speeding the work and saving time. Check the reply card.

Complete Line of Trenchers Covered in File of Catalogs

234. Many models of trenchers are covered in this set of literature from Parsons Co., Div. of Koehring Co., Newton, Ia. Check the reply card for complete specifications.

Single-Acting Pile Hammers

236. A 20-page engineering bulletin on the selection and application of single-acting pile hammers, using steam or air, with rated striking energy from 7,260 to 30,225 ft. lbs. is available from Vulcan Iron Works, 327 N. Bell Ave., Chicago 12, Ill. Check the reply card.

Armco Water Control Gates

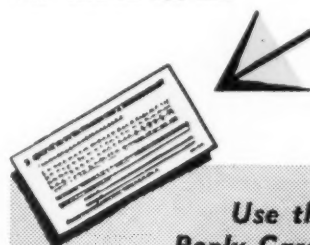
245. An illustrated bulletin from Armco Drainage & Metal Products, Inc., Middletown, Ohio, describes water control gates for municipal uses. Data are given on watertightness, range of operating heads and sizes. Check the reply card.

Pipe Cutter for Cutting Large Size Pipe

254. An all-purpose pipe cutter that can cut pipe in or out of the ditch is described in a bulletin available from Ellis & Ford Mfg. Co., P. O. Box 308, Birmingham, Mich. Check the reply card for sizes and parts list.

Positive Screenings Removal With Front Cleaned Bar Screens

255. Drawings, specifications, operation data and advantages of the Rex front cleaned bar screens are covered in Bulletin No. 315-21 available from Chain Belt Co., Milwaukee 1, Wis. Check the reply card.



Use the
Reply Cards
For Prompt Service

AMERICAN METERS

HAVE WHAT THE WATER SUPERINTENDENT
WANTS



**ACCURACY
UNSURPASSED**

AMERICAN Solid Casing Meter

**THICK DISC
PRECISION
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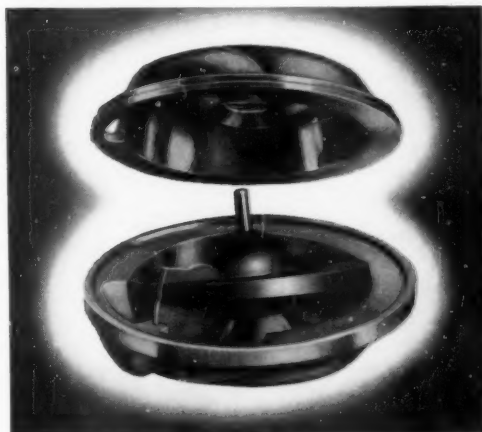
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Yes, tests prove, AMERICAN METERS have the high degree of Accuracy Water Superintendents want!

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To order these helpful booklets check the reply card opposite page 34.

NEW LISTINGS (Cont.)

Westinghouse Silverliners With or Without Built-In Ballast

259. For complete catalog on these mercury luminaires check the reply card or write Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland, O. Full details are covered on these lighting units.

Manual on the Use and Application of Compactors

261. A Manual covering the various types of compaction equipment in use today and including rollers and vibratory compactors is available from The Galion Iron Works & Mfg. Co., Galion, O. Check the reply card for details on the problems encountered in the efficient compaction of various materials, and the correct use of compaction equipment available.

Traffic Monitor Used in the Study of Expressway Traffic

262. The Electro-Matic Traffic Monitor makes available to both traffic and highway engineers the means for utilizing expressway type facilities more efficiently with greater safety and economy. Check the reply card or write Automatic Signal Div., Eastern Industries, Norwalk, Conn., for complete catalog.

Manual on Maintenance and Buying Guide of Paints

267. This 240-page manual covers paints of all types, abrasives, brooms, brushes, masonry waterproofing, structural steel maintenance and hundreds of other items used in maintenance. Check the reply card or write the Pittsburgh Plate Glass Co., Paint Div., 1 Gateway Center, Pittsburgh 22, Pa., for this valuable Manual.

Data on Rubber Seated Butterfly Valves

269. Design data and dimensions on Kinney butterfly valves are covered in Bulletin 750 available from S. P. Kinney Engineers, Inc., Carnegie, Pa. Check the reply card today.

Zimmerman Process Pilot Plant Report

274. The use of the Zimmerman Process in disposal of sewage sludge in a pilot plant operated by the Chicago Metropolitan Sanitary District, operating results, and principles of the process are described in an 18-page report by Sterling Drug Inc., 1450 Broadway, New York 18, N. Y. Check the reply card.

Weeds Controlled by Using Simazin 50W

278. General weed control is accomplished by using Simazin 50W and water. For full information on this new pre-emergence herbicide and how to use it write Gaigay Agricultural Chemicals, P. O. Box 430, Yonkers, New York.

Use The Reply Card

Case Utility 310B Backhoe-Loader

282. The Case wheel-mounted backhoe-loader is described and illustrated in 8-page, 3-color Bulletin CUS-110, released from J. I. Case Co., Racine, Wis. Check the reply card for mechanical details of the backhoe, loader and heavy-duty tractor.

Waterworks and Municipal Castings

293. Meter boxes and covers, yokes and couplings, service boxes and manhole covers are covered in 24-page catalog. Check the reply card or write H. W. Clark Co., Mattoon, Ill., for full specifications.

Catalog on Aluminum Chain Link Fence

297. Specifications on aluminum chain link fence are covered in catalog available from Nichols Wire & Aluminum Co., 1725 Rockingham Road, Davenport, Ia. Check the reply card.

From a Stump to Chips in Minutes

303. Pow-R-Stump cutter is operated by one man, handles stumps of any width and up

to 33 ins. in height and will not damage curbs, driveways or sidewalks. For literature check the reply card or write Vermeer Mfg. Co., Pella, Ia.

These Crosswalk Markings Outlast Paint 4 to 6 Times

307. Crosswalk markings of Perma-Line, the quick setting line that is easily applied, trouble-free, economical, and which outlasts paint 4 to 6 times, is described in literature of the Veon Chemical Corporation, 22-09 Bridge Plaza North, Long Island City 1, N.Y. Available in reflectorized white or yellow. Tests under your local conditions are invited.

Facts on Municipal Truck Equipment from Daybrook

311. Dump bodies and hoists, power loaders and Power Gates are covered in portfolio of truck equipment especially prepared for municipal management and available from Daybrook Hydraulic Div., Young Spring & Wire Corp., Bowling Green, Ohio.

All Purpose Maintainer for Road Departments

313. Attachments for Huber-Warco maintainers include a lift-loader, backfilling blade, bulldozer, broom, patch roller, snow plow and mower. For Bulletin No. HWM512 write Huber-Warco Co., Marion, Ohio, or check the reply card.

Hough Payloaders for City, County and State Operations

323. Hough Payloader Model H-90 can be used on many road construction and maintenance jobs, and its operation, specifications and attachments available are covered in literature from The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Ill.

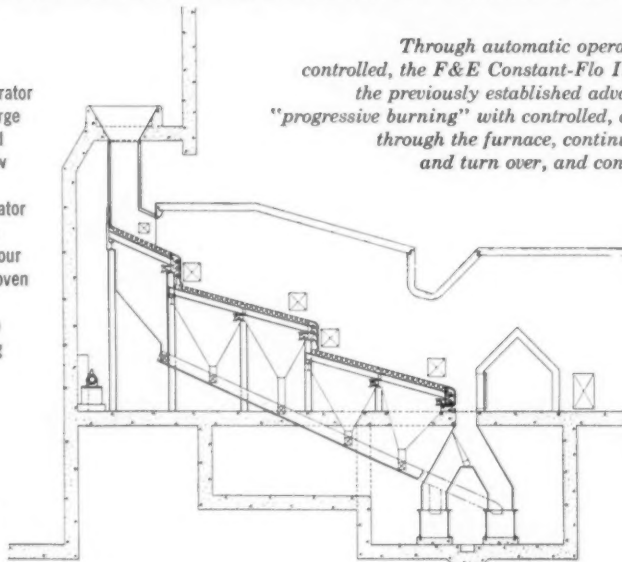
Automatic Controls for Water and Sewage Treatment

354. Controls of flow, temperature or level, using pneumatic or electronic controllers are covered in bulletin from Bailey Meter Co., Water & Waste Treatment Div., 1055 Ivanhoe Road, Cleveland 10, O.

F & E Constant-Flo Incinerator Stoker

Companion Stoker—F&E Standard Incinerator Stoker

In addition to the F&E Standard Incinerator Stoker for batch charge plants, the Flynn and Emrich Company now offers the F&E Constant-Flo Incinerator Stoker... using the latest application of our already tried and proven F&E Incinerator Stokers... for those municipalities calling for "Constant-Flo" operation.



Through automatic operation, electronically controlled, the F&E Constant-Flo Incinerator Stoker combines the previously established advantages of F&E "progressive burning" with controlled, constant flow of material through the furnace, continuous agitation, break up and turn over, and controlled residue disposal.

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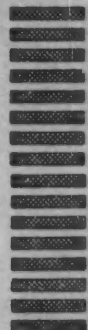
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Indiana Section, AWWA
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Newark, N. J., Feb. 10

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Short School, Texas A & M College
College Station, Texas, Mar. 1-6

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Chicago, Ill., Mar. 16-20

**Louisiana Section, FSIWA and Short Course
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Baton Rouge, La., Mar. 18-20

New England Section, AWWA
Boston, Mass., Mar. 19

**8th Southern Municipal and Industrial
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Chapel Hill, N. C., Apr. 2-3

Southeastern Section, AWWA
Columbia, S. C., Apr. 5-8

**5th Nuclear Congress including: Nuclear
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ment; Atomfair.**
Cleveland, Ohio, Apr. 5-10

New York Section, AWWA
Rochester, N. Y., Apr. 8-10

**American Water Works Assn.
California Section, AWWA**
San Francisco, Cal., July 12-17

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Seattle, Wash., Sept. 20-23

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Dallas, Tex., Oct. 12-15

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At left is the Barber-Greene Continuous Plant; at right is the BatchOmatic. Together these plants produced all asphalt tonnage on the test road. Both proved their ability to meet abnormally rigid specifications.

Barber-Greenes meet tight AASHO test road specs

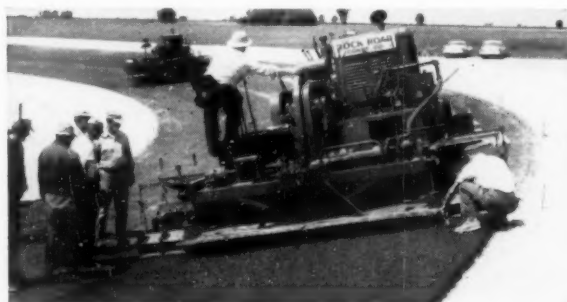
Two Barber-Greene Asphalt Plants, a continuous type and a BatchOmatic, produced every ton of asphalt mix on the AASHO test road near Ottawa, Ill. Every ton was laid with Barber-Greene Finishers.

Specifications on this important test road were more rigid than any normally encountered in highway work. Probably no asphalt mixing and paving equipment has ever before been called upon to meet such close tolerances.

Hundreds of combinations of asphalt mixes and base

and surface thicknesses were required. Each operation had to fall within the time limits specified by a rigid time schedule.

"We knew that Barber-Greene Asphalt Plants and Finishers had the ability to meet these rigid specifications," commented the asphalt contractor, Rock Road Construction Company of Chicago. With over 20 years' experience in the operation of Barber-Greene Asphalt Paving Equipment, the results again justify their confidence in Barber-Greene.



Paving steep super-elevations while staying within close specification tolerances was just one of the stringent requirements successfully met by Barber-Greene Finishers on the test road.



Paving on crawlers and traveling on rubber, the new Barber-Greene Model 873 Finisher paved all the test road's 6' asphalt shoulders in four days—at 64 different locations.

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PUBLIC WORKS for January, 1959

35

To order these helpful booklets check the reply card opposite page 34.

Complete Line of Shovels, Draglines, Cranes and Clamshells

361. Bucyrus-Erie crane-excavators in sizes from 1½ to 4 cu. yd. capacities are covered in literature from Bucyrus-Erie Co., South Milwaukee, Wis.

Data on Transits for Engineering Departments

367. K&E Paragon transits are covered in literature available from Keuffel & Esser Co., Dept. PW, Hoboken, N. J. Transits have enclosed achromatic telescope, chrome plated draw tube, stainless steel axle journals, one-piece spanned vernier disc and chrome plated center.

3M Letters for Large Reflectorized Signs

374. 3M signal letters are made with Scotchlite reflective sheeting and are used on large reflectorized signs. Check the reply card or write Minnesota Mining and Mfg. Co., St. Paul 6, Minn., for full details.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans., for your copy.

Winter Road Maintenance With Calcium Chloride

386. This bulletin contains data on why calcium chloride mixtures work better, how and in what percentages to store, mixing methods and recommendations for various storm conditions. Check the reply card or write Columbia-Southern Chemical Corp., One Gateway Center, Pittsburgh 22, Pa., for your copy.

Cushman Truckster Hauls an 800 lb. Payload

392. Complete information on the Cushman Truckster is available from Cushman Mo-

tors, 1005 No. 21st., Lincoln, Nebr. Features are constant mesh transmission, hydraulic brakes, 12-volt lighting system, etc.

Road-Building Applications of Byers 4-D Wrought Iron

393. Technical data on specific applications of Byers wrought iron used as snow melting systems, bridge decks, tie bars and dowels, scuppers and curb plates are available from A. M. Byers Co., Pittsburgh 22, Pa.

Austin-Western Graders Equipped with V-Plows and Wings

394. Information is available on Austin-Western graders and their use in snow removal. Check the reply card or write Austin-Western, Construction Equipment Div., Aurora, Ill., for full details on graders equipped with V-plows and wings.

HERE'S WHERE PLIBRICO CUTS INCINERATOR EXPENSE

It's the furnace lining that's subjected to greatest abuse... and this Plibrico lining in a typical municipal incinerator is built to take it! Plibrico's own quality refractories combine to meet the specific needs of every furnace zone. Free from the countless joints where trouble so often begins, they form a continuous one-piece lining featuring positive anchorage, sectional supporting, and air-cooling as required. It's a lining that's engineered and installed by skilled Plibrico workmen.

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WATER WORKS

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Meter Features That Help Make Water Works Profitable

59. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American Water meters described in Bulletin No. 56 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Check the reply card.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

Simplified Rate-of-Flow Controller for Filters

106. The "Modulair" is a self-contained unit which may be inserted in a rapid sand filter effluent line for rate-of-flow control. Its application and compact, simplified construction are described and illustrated in color in Bulletin 951. Write Simplex Valve and Meter Co., Lancaster, Pa., or check the reply card.

Right Angle Gear Drive For Centrifugal Pumps

107. Applications, gear drive selection tables, pulley data, efficiencies and standard dimensions of Johnson right angle gear drives are covered in catalog from Johnson Gear & Mfg. Co., Ltd., Eighth and Parker Sts., Berkeley 10, Calif. Check the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp., Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

Here's EXTRA STABILITY for EXTRA PRODUCTION ... Greater Operator Comfort

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Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Now Every Municipality Can Own a Trencher

173. The low cost of the ARPS Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

Heavy Duty Air Cooled Engines For Many Uses

223. Power and weight specifications, dimensions and uses are fully covered in literature issued by Wisconsin Motors Corp., Milwaukee 46, Wis., on their air-cooled engines. Also available is a service map and a list of their distributors and approved service stations.

Catalog on Dewatering Pumps

226. Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP7 from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

Foxboro Magnetic Flow Meter

238. The Foxboro magnetic flow meter measures water and wastes electrically, without any line restriction. No loss of head, no fouling, even with slurries. For detailed illustrated Bulletin 20-14B check the reply card or write The Foxboro Co., Foxboro, Mass.

Mueller Copper Water Meter Yokes

242. Copper meter yoke provides a tailor-made setting with fewer joints and fittings and it permits the installation of service lines without placing the meter. Check the reply card or write Mueller Co., Decatur, Ill., for complete information.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

Outline of Modern Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaueller-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

Chapman Standard Sluice Gates

276. Manual, hydraulic or electric motor control sluice gates are described fully in Catalog 25 available from The Chapman Valve Mfg. Co., Indian Orchard, Mass. These valves are easy to replace and are fitted without alterations. Check the reply card.

SAFETY ALARM SETS



Model AL

SYNCHRO-START Safety Alarm Sets contain all the necessary relays, switches, and signal lights to warn the operator of any abnormal condition existing in the engine.

Three switches are provided — control "on-off" — test — audible alarm cut-off. For added protection these alarm sets may be equipped with automatic shut-down in case signals are not heeded.

This model is mounted in a dust-proof steel cabinet with knockouts for conduit wiring and terminal bar for easy hook-up. Available in all standard voltages up to 120 Volt maximum.

Request Bulletin 503

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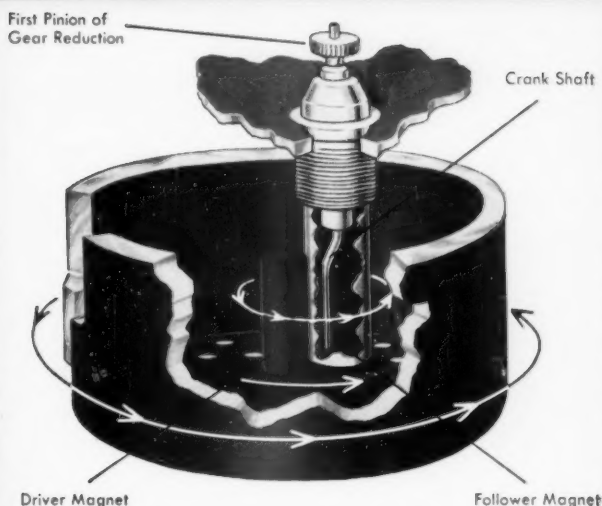
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The magnetic drive itself is fully shielded to prevent "cheating." And its powerful magnetic force is good for a lifetime of operation. For descriptive bulletin write Rockwell Manufacturing Co., Pittsburgh 8, Pa.



SEALED REGISTER METERS

another fine product by

ROCKWELL



To order these helpful booklets check the reply card opposite page 34.

Review of Diatomite Filtration of Water

385. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Department, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin BW-13 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Morton Purex Salt For Water Plants

324. Sludge-free Morton Purex salt is described in literature from Morton Salt Co., Industrial Div., Dept. PW 6-58, 110 N. Wacker Drive, Chicago 6, Ill. Check the reply card for information on this 100 percent soluble salt.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are 3/4"-3/4"x3/4"-3/4" and 1". Check the reply card.

Governors and Speed Switches

340. New style governors and speed switches which have a variety of applications are covered in bulletins from Synchro-Start Products, Inc. 8151 No. Ridgeway Ave., Skokie, Ill. Check the reply card for prices and specifications.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind.

Use The Reply Card

Sealed Register Water Meter Contains 15 Stock Parts

445. A 20-page Catalog No. W-811, describing the Rockwell sealed register meter includes illustrations, drawings specifications and color photos. Check the reply card or write Municipal and Utilities Division, Rockwell Manufacturing Company, 400 N. Lexington Avenue, Pittsburgh 8, Pa., today for complete parts list with illustrations and specifications.

Cleaning and Relining Water Pipe the Easy Way

397. Complete facilities for relining cast iron or steel water pipelines in place from 4" to 144" in diameter, with the Spunline (TM), Tate and Centriline Processes offered by Pipe Linings, 2414 E. 223rd St., Wilmington, Calif. For full information on cleaning and relining pipe with only momentary interruption of service, check the reply card.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLaval centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

How to Choose the Right Self-Priming Centrifugal Pump

427. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in. models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Badger Read-o-Matic Register For Outside Water Meter Reading

536. The Read-o-Matic is simple to install and requires no outside power. Doorbell-type wire carries the pulse from generator in meter to the register on the outside of the building. Check the reply card or write Badger Water Meters, 4545 West Brown Deer Road, Milwaukee 18, Wisc.

Bulletin Helps Specify A.W.W.A., Gate Valves

547. Double disc gate valves in 2" to 60" sizes are fully described in a 16-page bulletin which gives details on valve parts, design, materials, application of the "O" Ring Seal, operation and operating devices, directions for ordering valves and parts, dimensions of all sizes, and descriptions of eleven different methods for end connections. Valves for horizontal operation, square bottom valves, many types of gearing and gear cases, and a complete listing of special controls available are included. Get Bulletin A from Rensselaer Valve Co., Troy, N. Y. by checking the reply card.

Manual on Valves, Fire Hydrants and Accessories

559. A 244-page manual covering Darling valves and fire hydrants in a broad range of types, sizes and constructions is available from Darling Valve & Mfg. Co., Williamsport, Pa. Engineering data, application tips, valve accessories information, reference data on materials, specifications and standards are covered.

Modern Elevated Water Tanks

566. A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheroid, is available from the Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered.

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours is described in literature from Wilkinson Products Co., 3987 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Handbook on Selecting Power For Pumping

694. A 12-page power selection handbook, "Selecting Power For Pumping," has been released by the Advertising Div., Caterpillar Tractor Co., Peoria, Ill. This handbook is especially useful to those who have a pumping operation. It contains a checklist of features necessary for continued dependable operation on pumping jobs. List describes the proper requirements which an engine must have, backing them with illustrations and examples of efficient installations. Check the reply card today.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N.J. Check the reply card and we will forward your request.



ALA. G.C. Phillips Tractor, Birmingham, Prichard
ALASKA The Carrington Co., Seattle, Wash.
ARIZONA Equipment Sales Co., Phoenix
ARK. Clark Equipment Co., Little Rock
Tri-State Eqt. Co., Memphis, (Tenn.)
CALIF. Brown-Bevis Ind. Eqt. Co., Los Angeles
Standard Mach. Co., San Francisco
COLO. H. W. Moore Eqt. Co., Denver, Gr. Jct.
CONN. Eastern Eqt. Sales Inc., West Haven
DEL. Ransome Corp., Bear
FLA. Square Deal Mach. & Sup. Co., Inc., Orlando
Square Deal Mach. of Miami, Miami
Square Deal Mach., Inc., Jacksonville
G. C. Phillips Tractor, Birmingham (Ala.)
GA. Stith Eqt. Co., Atlanta
IDAHO Feenaughty Mach. Co., Boise
Rocky Mt. Machinery, Salt Lake City (Utah)
ILL. Illinois Cont. Mach. Inc., Elmhurst, Peoria,
Rock Island
Koste Machinery Co., Robertson (Mo.)
IND. Reid-Holcomb Co., Indianapolis, Evansville
Illinois Cont. Mach., Elmhurst (Ill.)
Rish Eqt. Co., Cincinnati (Ohio)
IOWA Wendler-Kraus Eqt. Co., Inc., Cedar Rapids
Vivian Eqt. Co., Ames
Mo. Valley Mach. Co., Omaha (Nebr.)
KANS. G. W. Van Keppel Co., Kansas City (Mo.)
KY. Williams Tractor Co., Louisville, Paducah
Rish Eqt. Co., Cincinnati and Portsmouth (Ohio)
LA. General Eqt. Co., Baton Rouge
ME. Eastern Tractor & Eqt. Co., Portland
MD. Rish Eqt. Co., Clarksburg (West Va.)
Ransome Corp., Bear (Del.) and Philadelphia (Pa.)
MASS. Perkins Mach. Co., Needham Heights,
Springfield
MICH. Earle Eqt. Co., Detroit, Grand Rapids
Drott Tractor Co., Inc., Iron River
MINN. Wm. H. Ziegler Co., Minneapolis, Hibbing
Crookston, Duluth
MISS. Equipment Inc., Jackson
Tri-State Eqt. Co., Memphis (Tenn.)
MO. Koste Mach. Co., Inc., Robertson
G. W. Van Keppel Co., Kansas City
Tri-State Eqt. Co., Memphis (Tenn.)
MONT. Pioneer Eqt. & Sup. Co., Butte
NEBR. Mo. Valley Mach. Co., Omaha
Nebr. Mach. Co., No. Platte, Scottsbluff
Lincoln Eqt. Co., Lincoln
NEV. Sierra Mach. Co., Inc., Reno
N. H. Mingolla Mach. Co., Concord
N. J. Dale & Rankin, Inc., Hanover
Ransome Corp., Bear (Del.) and Philadelphia (Pa.)
N. MEX. N. C. Ribble Co., Albuquerque
Equipment Supply Co., El Paso (Tex.)
N. Y. J. C. Georg Const. Eqt. Co., Syracuse,
Schenectady, Lisbon
P-D Service, Inc., Pavilion, Buffalo
H. O. Penn Mach. Co., Inc., New York,
Poughkeepsie, Westbury (N. Y.)
NO. CAR. H. B. Owsley & Son, Inc., Charlotte
NO. DAK. Northwestern Eqt., Inc., Fargo, Minn.
OHIO Rish Equipment Co., Cincinnati, Cleveland,
Columbus, Dayton, Portsmouth, Toledo,
Youngstown, Parkersburg, (W. Va.)
OKLA. Leland Eqt. Co., Tulsa, Oklahoma City
ORE. Feenaughty Mach. Co., Portland
PENN. Watson Eqt. Co., Inc., Pittsburgh
Ransome Corp., Philadelphia
R. I. Perkins Mach. Co., Needham Heights,
Springfield (Mass.)
SO. CAR. Ray Long Eqt. Inc., Columbia
SO. DAK. Sioux Road, Inc., Sioux Falls, Rapid City
TENN. Tri-State Eqt. Co., Memphis
TEX. J. W. Bartholow Mach. Co., Dallas
Conley-Lott Mach. Co., Lubbock
Equipment Supply Co., Inc., El Paso
UTAH Rocky Mt. Mach. Co., Salt Lake City
VT. Mingolla Mach. Co., Barre
VA. Rish Eqt. Co., Richmond, Roanoke,
Bluefield (W. Va.)
Ransome Corp., Bear (Del.) and Philadelphia (Pa.)
WASH. Feenaughty Mach. Co., Seattle, Spokane
W. VA. Rish Eqt. Co., Bluefield, Charleston,
Clarksburg, Parkersburg
WISC. Drott Tractor Co., Inc., Milwaukee,
Madison, Rice Lake
WYO. Wortham Mach. Co., Cheyenne
HAWAII Edward R. Bacon Co. Ltd., Honolulu

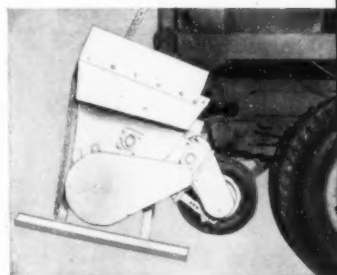


A grooved roller spreads blanket pattern for seal coating.

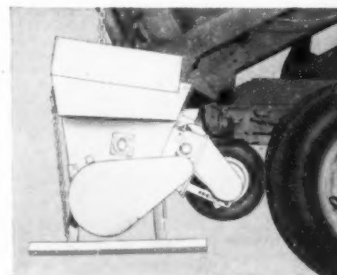


A spiral roller spreads echelon pattern for ice control.

Fast, Simple Operation!



In road-traveling position the Model J is up and out of the way.



In less than five minutes the driver can have the Model J locked into position. As dump body is raised, the traction tire comes in contact with the inside truck dual, putting the drive into motion. (Permits tire chains to be placed on the outside dual without interference.) Operates at speeds up to 30 mph.

Whether For Ice Control or Seal Coating HI-WAY Model J Tailgate Spreader Is Geared To Surface of The Road!

- Attaches to any standard dump truck
- Strictly one-man operation
- Spreads all granular materials . . . wet or dry
- Full 9 foot width

When ice conditions are bad, more sand, salt or cinders should be applied to the surface of the road. Since the Model J Spreader drive is positively synchronized to the speed of your rear traction tires, you merely adjust the feedgate to lay more material and regulate truck speed to road conditions.

The echelon pattern for ice control mechanically duplicates hand shoveling by laying materials in ridges that more quickly melt the ice. Other units spread a thin blanket that is easily blown off the road by traffic or wind. HI-WAY Model J, pioneer of the echelon spreading pattern, thus enables you to do a more effective job with less material.

For seal coating, depth of coverage is similarly controlled by a feedgate and

there is no wasteful free flow when truck is stopped. The dump body operates independently since the unit is hinged directly to the truck frame, *not* to the dump body. An optional block-off attachment adjusts width of spread up to 9 feet. Forward and reverse transmissions also available.



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HIGHWAY EQUIPMENT COMPANY

608 D. Ave. N. W.

Cedar Rapids, Iowa

INSTANT BRUSH DISPOSAL FITCHBURG CHIPPER DOES 3 MEN'S WORK



Charles Morris feeds roadside brush into Mahwah's Fitchburg Chipper.

When you want to cut brush disposal cost, investigate a Fitchburg Chipper, a real time and labor-saver.

John Glasgow, Superintendent of Public Works, Township of Mahwah, New Jersey, says: "Now I chip brush instead of putting it on piles and waiting for wet weather to burn. I mention wet weather because of fire hazard.

"The Fitchburg Chipper was purchased in May 1954. It will take only a short time to pay for itself. I hired 6 men to cut and clean up brush, now with the Chipper I only need 3 to do the same work."

You, too, can save man hours where there is a need for line clearance operations, road clearance, thinning out woodlots, or handling the brush problem on parkways, city streets, etc.

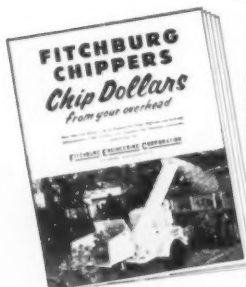
The Fitchburg Chipper is designed for rugged use, and in models priced from \$960 upward.

Learn about Fitchburg's exclusive spring-activated feed plate, which makes chipping of all sizes of wood (up to the machine's rated capacity) simple. Another exclusive feature is the hinged feed apron which can be closed when not in operation.

Read how others cut labor costs with a Fitchburg Chipper—the only chipper that gives you a one-year guarantee.

Send For New Free Booklet—"CHIP DOLLARS

FROM YOUR OVERHEAD." Complete with cutaway color drawings of Chipper in action. Specifications, etc.



FITCHBURG ENGINEERING CORPORATION

Department PW-19, Fitchburg, Massachusetts

Send my free copy of "Chip Dollars From Your Overhead" to:

Name _____ Position _____

Address _____

Town or City _____ State _____

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the Sewelcode, hand tools and all accessories. Water main and culvert cleaning methods are included.

Engineering Data on Screening Equipment

77. Water, sewage and industrial waste screening equipment is fully described in a 28-page book, No. 2587, offered by Link-Belt Co., Colmar, Pa. Complete data for the engineer and tables to determine the proper size unit for handling various capacities are included. This valuable comprehensive booklet may be obtained by checking the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Sealed Electrode Floatless Pump Controller

99. The floatless pump controller is a valuable accessory for sewage and drainage sump pumps for it is never affected by corrosive elements, has no moving parts and cannot become coated with grease, oil or soap. For design data and specifications write Food Machinery and Chemical Corp., Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., or check the reply card.

Buckets and Grapples For Incinerator Service

110. Bulletin provides comprehensive information on the 5 sizes of 2-line, lever arm, clamshell-type buckets; standard 2-line, tine-type grapples; equalizer arrangements and certain incinerator buckets for single drum hoists. Check the reply card or write Blaw-Knox Co., 300 Sixth Ave., Pittsburgh, Pa., today.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

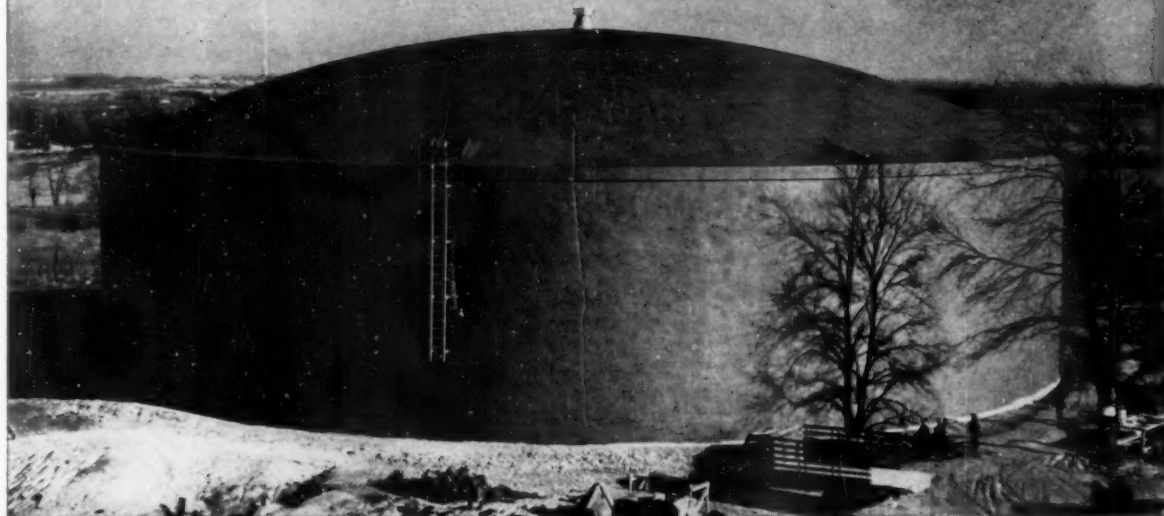
Blower Selection Data Aids Sewage Plant Design

144. Characteristic curves for blower operation with constant-speed, multi-speed and variable speed motors; details of several types of blowers; data on accessories; and a discussion of advantages of positive displacement rotary blowers are provided in Bulletin RB 154 of Roots-Connorsville Blower Div., Connorsville, Ind.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise" published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

MAINTENANCE FREE



3,000,000 gallon tank,
Montgomery County
(Dayton), Ohio

PRESTRESSED CONCRETE WATER TANKS

- No maintenance required
- Over 2000 tanks in service
- Owners never return to other types
- Lowest overall cost to community
- 75% construction cost spent locally

If your growing community has a water storage problem, by all means consider a Preload Prestressed Concrete Tank. Overall \$ savings to your community can be phenomenal. Call or write today for more information. Send for Bulletin T-22.

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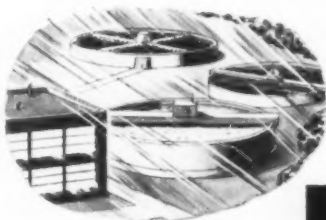
351 Jefferson
Dallas, Texas
Phone: WHitehall 1-5707

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711 Perimeter Road
Kansas City, Missouri
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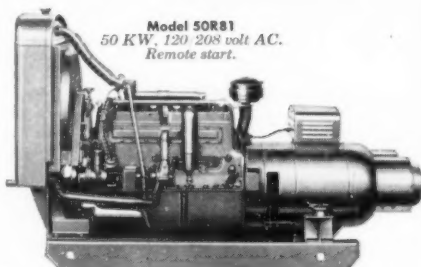
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Reliable emergency power for filtration, treatment plants

KOHLER ELECTRIC PLANTS

Kohler plants supply power automatically when emergencies cut off regular supply. Operate sewage treatment and filtration equipment essential to public welfare. Engineered for minimum maintenance; easy to install . . . *Portable power for street repairs.* Lightweight, 4-cycle, quick starting models for on-the-job power tools, night lighting . . . Sizes to 100 KW, gasoline or diesel. Write for folder D-11.

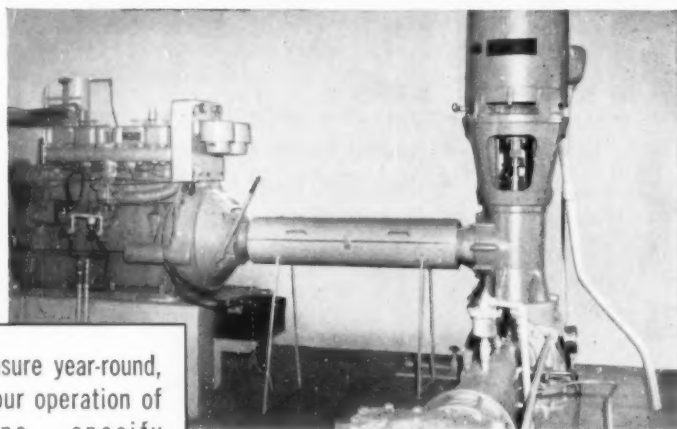


Model 50R81
50 KW, 120-208 volt AC.
Remote start.

KOHLER CO., Established 1873 Kohler, Wis.

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Enamelled Iron and Vitreous China Plumbing Fixtures • Brass Fittings
Electric Plants • Air-cooled Engines • Precision Controls



To insure year-round, 24-hour operation of pumps . . . specify

JOHNSON *Right angle* GEAR DRIVES



Protects water supply, sewage and flood control operations against power failures; also permits overhauling electric motor or power unit without interrupting service. Thousands in use by municipalities, industry and farmers. Available in turbine or engine driven combination drive (as shown here), standard and dual types, with either hollow or solid shaft. Sizes: 15 to 450 hp. Write now for engineering catalogs.

JOHNSON MAKERS OF FINE GEARS SINCE 1904
GEAR & MANUFACTURING CO., LTD.
8TH AND PARKER STREETS • BERKELEY 10, CALIFORNIA

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holiday and Saratoga Sts., Baltimore 2, Md.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

423. Latest information on the Komline-Sanderson "Coilfilter" which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeKoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Lining of Building Stacks in the Operation of Incinerators

555. Monolithic linings for full protection of stacks and breechings are covered in literature from Plibrico Co., 1800 Kingsbury St., Chicago 14, Ill. Illustrations picture and briefly describe typical installations. Check the reply card.

V-Notch Chlorinators

For Water and Sewage Plants

590. Bulletins on the Series A-711 and the Series A-712 chlorinators are available from Wallace & Tiernan Inc., Box 178, Newark, N. J. Covered in the literature are design features that include operation, installation and maintenance. Simplified flow diagrams in color are included showing the operation of the units. Class, capacities, feed ranges and electrical requirements are described in the technical data section. For your copies, check the reply card.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

STREET LIGHTING AND TRAFFIC CONTROL

Engineering Data on Aluminum Lighting Standards

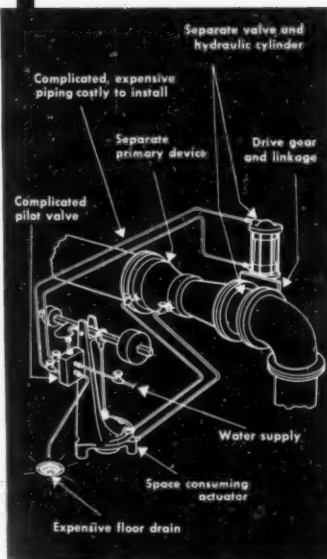
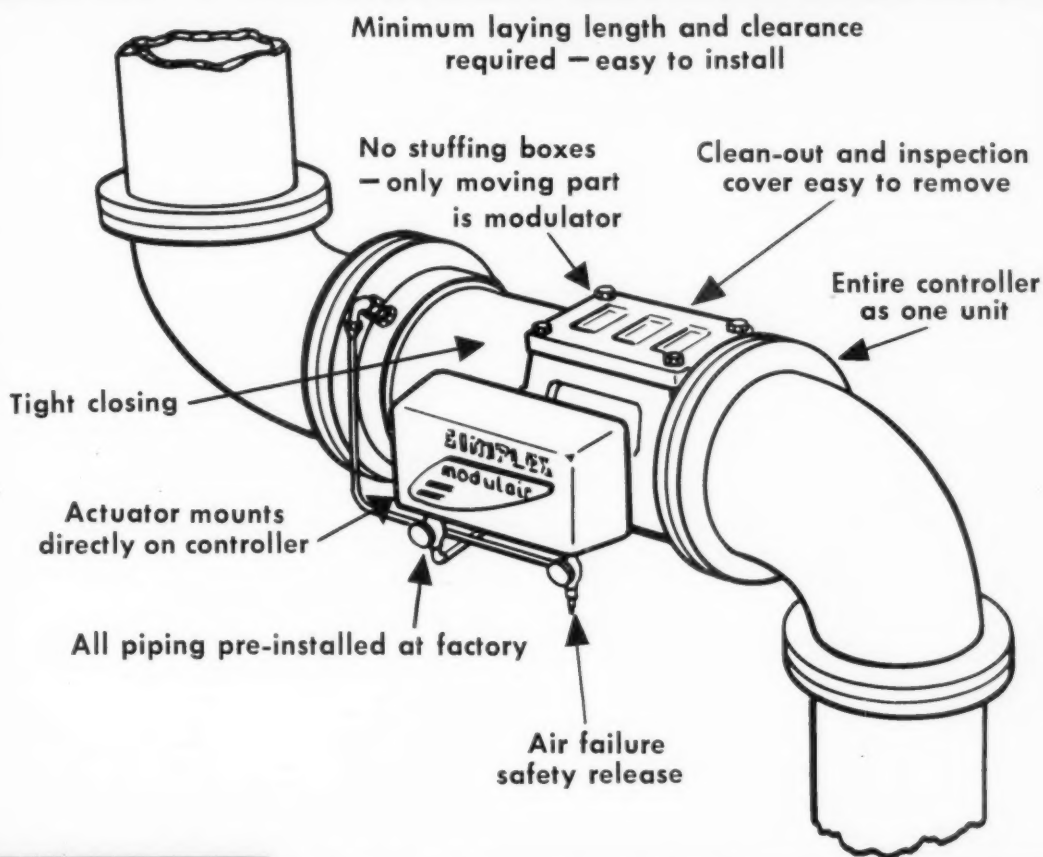
256. Latest designs and applications of all-aluminum, seamless, tapered lighting standards, and elliptical lighting brackets plus detail drawings and mechanical specifications are provided in a comprehensive 16-page bulletin issued by Pfaff & Kendall, 84 Foundry St., Newark, N. J.

Monotube Poles for Highway Lighting and Signing

432. Highway pole designs, in both steel and aluminum, as well as various overhead sign mounting arrangements are illustrated in Catalog L.S.23 available from The Union Metal Mfg. Co., Canton 5, Ohio. Check the reply card for base and bracket details and other specifications.

Aluminum Lighting Standard Catalog

768. This 16-page catalog contains complete engineering data and illustrations of the various types, sizes, weights and spans of lighting standards. Check the reply card or write Kerrigan Iron Works, Inc., Nashville 2, Tenn., for this valuable catalog.



COMPARE and see how new Modular[®] Flow Controller makes this design obsolete

best of all . . .

Simplex Modular saves you money three ways

During 6 years of extensive use, the Modular Rate of Flow Controller has proved time and time again that it can save money three ways:

1. Its unit construction makes it your best buy on a first cost basis.
2. You save installation time and money. Modular is as easy to install as a piece of pipe.
3. Maintenance is practically nil, because of Modular's exceptionally simple design.

If all this interests you, write for our Bulletin 951.

SIMPLEX[®]

VALVE AND METER COMPANY

LANCASTER, PENNSYLVANIA

a subsidiary of PFAUDLER PERMUTIT INC.

To order these helpful booklets check the reply card opposite page 34.

STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.

Foundation Investigation and Pressure Grouting

48. Foundation investigation and pressure grouting and the various miscellaneous services of Sprague & Henwood are described and illustrated in literature from Sprague & Henwood, Inc., Scranton 2, Pa. Check the reply card.

Use The Reply Card

Chip Dollars from Your

Overhead With Fitchburg Chippers

160. Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. PW, Fitchburg, Mass.

Check List for Successful Earthmoving Bids

147. Valuable information for the earthmoving contractor and for the engineer who must estimate earthmoving costs is provided in a new two-color illustrated booklet issued by Caterpillar Tractor Co., Peoria, Ill. A convenient check list is included to help select the proper equipment for the job. Check the reply card to get Form No. DE502.

Illustrated Specifications on

Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 505 York Road, Jenkintown, Pa., or use the handy reply card.

New Reflectorized Sign Faces

Refurbish Old Traffic Signs

292. Get complete details on new "EZ-On" traffic sign faces ready for immediate shipment. Reflectorized faces cost about one half as much as new signs and are easily attached to existing traffic signs. Grace Sign & Mfg. Co., St. Louis 18, Mo.

Hand Operated

Soil Sampling Kit

366. Bulletin 26-R describes the Acker soil sampling kit that contains 12 different soil sampling tools packed in a handy steel case. Check the reply card or write to Acker Drill Co., Inc., Scranton 2, Pa., for data on tools that are designed to take soil samples from practically any material.

Bridge Concreting,

Its Problems and Solutions

390. A 16-page catalog illustrating the concreting problems involved in bridge construction is available from The Master Builders Co., Cleveland 3, Ohio. The catalog covers concreting of piers and bridge decks for highway and railway bridges, and includes discussions of hot and cold weather concreting, the use of lightweight aggregate in bridge work, and placing and finishing problems encountered in bridge work. Check the reply card for Catalog MBR-P-11.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Complete Line of

Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Specification Sheets on John Deere Tractors and Equipment

588. Information and specifications on the John Deere crawler and wheel-type industrial tractors and working equipment. Deere & Co., Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Complete Line of Earth Boring Machines

591. A 16-page illustrated catalog on the Hydrauger line of boring machines has been released. Field operation photos and views showing embankment drainage and pipe line installation are included in this material available from Hydrauger Corp., Ltd., 681 Market St., San Francisco, Calif.

Construction Methods for Salt Stabilized Roads

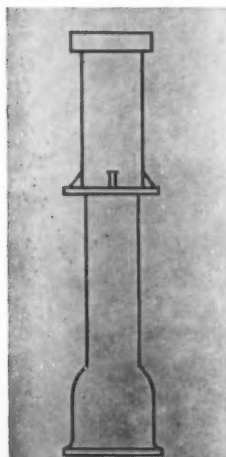
609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 110 N. Wacker Drive, Chicago 6, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.



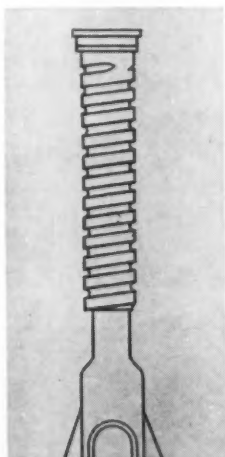
BUFFALO MUNICIPAL CASTINGS

are available in every size and style!

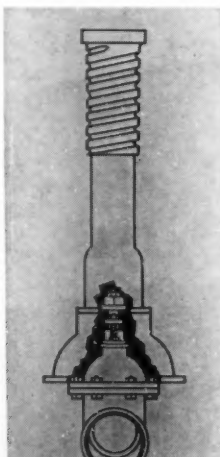
No matter what size, shape or style municipal casting you may desire — you're practically sure to find a "Buffalo" casting to serve your needs. Or, where desired, castings may be made to your own specifications. Whether you need valve, service or roadway boxes, meter boxes, manhole rings and covers or other municipal castings, you'll find all "Buffalo" castings designed for service and dependability.



2 pc. sliding type
adj. 5 1/4" valve box



2 1/2" water or gas
ext. service box



3 pc. screw type
5 1/4" valve box

Prompt quotations given on all your standard or special gray iron or non-ferrous castings.

Write or wire Dept. J for Bulletin MII.



BOX 55 — STATION B DE 6764 BUFFALO 7, N.Y.



When the log jam breaks...

Thousands of tons of timber will be unleashed on the waters of the river. Similarly, our explosive surge of population is bearing down on already overburdened water works facilities in many communities.

New pipelines are essential; but only pipe of sustained high carrying capacity can meet greater demands with constant, predictable volume. That's why efficiency and economy dictate the use of LOCK JOINT CON-

CRETE PRESSURE PIPE for water supply and distribution lines. Its first low cost, ease of installation, long life, negligible maintenance and permanent high carrying capacity represent immediate and long term economies.

To bolster your water system against the shock of our yearly 3,000,000 increase in population, specify LOCK JOINT CONCRETE PRESSURE PIPE for complete dependability and over-all economy.



LOCK JOINT PIPE CO.

East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo. • Perryman, Md.

Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

To order these helpful booklets check the reply card opposite page 34.

Chevrolet Trucks for 1959

642. Chevrolet trucks for 1959 feature more models, thriftier engines, stronger cabs and frames, safer brakes and tougher axles and transmissions. Write to the Chevrolet Div., General Motors, Detroit 2, Mich., or check the reply card for complete data on these new trucks.

Better Roads

With Sterling Rock Salt

650. This manual describes the simplified 7-step method of road improvement with rock salt. This type of salt stabilization is designed for cities, townships and counties. Check the reply card or write Highway Sales Dept., International Salt Co., Scranton, Pa., today.

Design of Concrete

Pavements For City Streets

657. Sections covered in this manual are classes of streets as to traffic, quality of concrete, working stress and safety factor, types of pavement design, design procedure, jointing of municipal pavements and use of distributed steel. Check the reply card or write Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.

Catalog on Road

Rollers and Compaction Equipment

667. Two and 3-axle tandem rollers, 3-wheel variable weight rollers and the Kompactor are covered in this catalog from Buffalo-Springfield Roller Co., Springfield, Ohio. Specifications, models and features are included. Check the reply card today.

Sweepers Handle A Variety of Jobs In Every Season

684. Mechanical drive one-way and pull type 2-way sweepers and hydraulic 2-way sweepers that are tractor-mounted or loader-mounted are fully covered in literature from M-B Corp., 1611 Wisconsin Ave., New Holstein, Wisc. Jobs like cleaning dust, dirt and snow from streets and highways and sweeping park lawns are a few of the sweepers applications. Check the reply card.

CONSTRUCTION EQUIPMENT AND MATERIALS

Tractor Loader Can Be Converted Into Eight Different Machines

38. Multiple-purpose tractor loader can be converted to a street sweeper, backhoe, fork lift, angle dozer, crane and rotary broom in a short time. Check the reply card or write Massey-Ferguson Industrial Div., 1009 South West St., Wichita 13N, Kana., for well illustrated catalog.

For Fast, Smooth

Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

How to Get

Better Grader Operation

111. A most interesting and instructive 20-page illustrated action booklet on how to operate a motor grader is now available from Galion Iron Works & Mfg. Co., Galion, Ohio. Designed to help operators get more effective use from the versatile motor grader, this booklet covers the hydraulic system, steering, tips on leaning wheels, proper blade positioning, turning, gear speeds and operating procedures. Colorful, easy-to-read presentation guarantees good readership. Check the reply card for your copy.

Design Manual on

Complete Structural Systems

100. Manual contains technical information relative to Stran-Steels line of joists, studs, channels, ribbed decking and metal curtain walls. It is well illustrated and contains several pages of loading tables. For this valuable Manual write Stran-Steel Corp., Detroit 29, Mich., or check the reply card today.

Booklet Shows Design of

Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your buildings needs. In a helpful 16-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection, and many illustrations of typical uses. Write to Butler Mfg. Co., Kansas City, Mo.

Restoration and Protection

Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication.

Use The Reply Card

4-Wheel Drive

Tractor Loaders

434. A 16-page Catalog, No. 1033-5-57, describing the "Tracto-Loader Line" of front end wheel loaders is available from Tractomotive Corp., Deerfield, Ill. Covered are the five models that are in production.

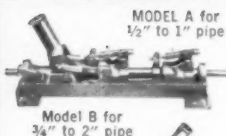
Self-Propelled

Ditching Machines

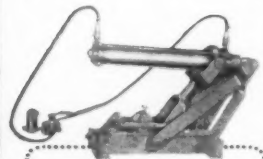
436. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

(More listings on page 52)

Only the Trojan Pipe Puller & Pusher gives you continuous action... No Resetting of Grip!



Model B for
¾" to 2" pipe



**NEW AIR POWERED
Model B**

Does all the work for you.
Handles ¾" to 2" pipe.

**CUTS COSTS!
SAVES TIME-**
in installing or renew-
ing pipe under pavement

The Trojan combines pushing and pulling operations in one machine—eliminates all time-killing resetting of grip—keeps pipe continuously moving. Does the job at lower cost—in far less time.

Model A weighs 65 lbs.—requires only 5' trench. One man can easily install the average service. 15 tons of pushing pressure possible.

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the major phases of...

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By JOSEPH A. SALVATO, JR., Rensselaer County Health Department, N.Y. Filling the need for more information on the rural and suburban environment, this book particularly stresses the practical application of sanitary and public health engineering theory and principles to the smaller community, installation, or facility of less than 1000 to 5000 persons. It is extensive in scope and directly applicable to real conditions. The authors have included planning, design, construction, maintenance, and operation details, as well as administration of environmental sanitation activities. With empirical formulae, rules of thumb, charts, tables, and other summations. 1958. 660 pages. Illus. \$12.00

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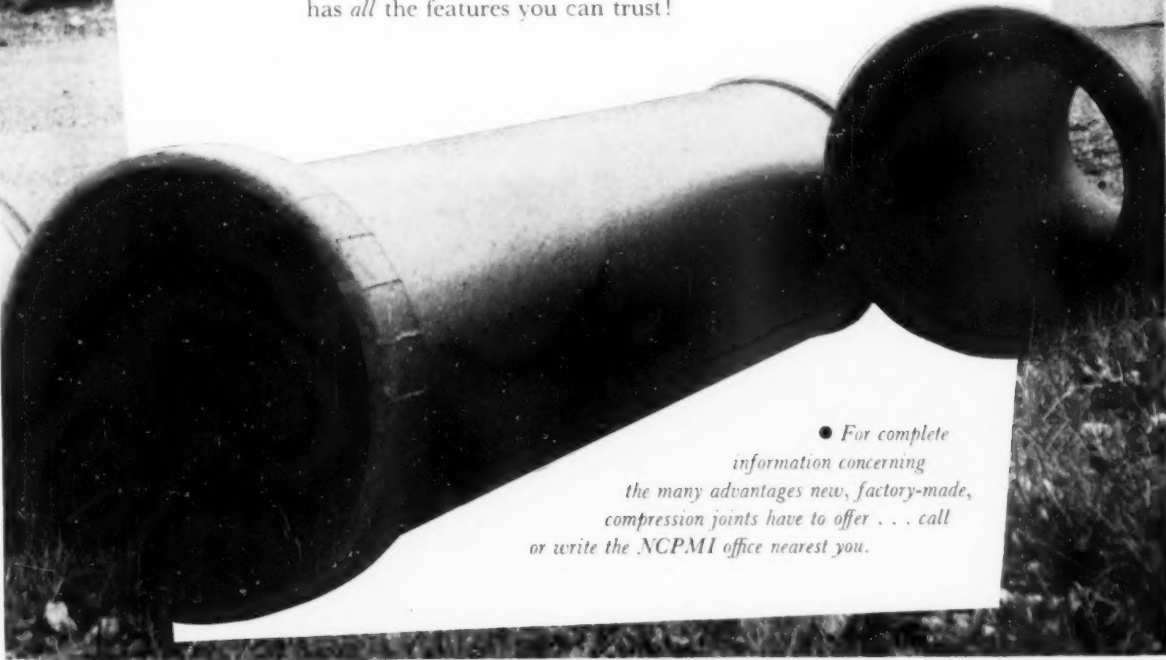
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New factory-made Compression Joints Stop Infiltration

Concern over meeting rigid infiltration requirements is now a thing of the past. From the research laboratories of the Clay Pipe Industry comes new, factory-made, compression joints that control infiltration to strict specifications . . . reduce pumping cost to an absolute minimum. Together with new, longer, stronger lengths, these revolutionary joints make Vitrified Clay the fastest, most economical to install . . . the most efficient in performance, as well as the longest-lasting pipe ever developed for sanitary and waste installations. Now, more than ever before, only Clay Pipe has *all* the features you can trust!



● For complete information concerning the many advantages new, factory-made, compression joints have to offer . . . call or write the NCPMI office nearest you.

Vitrified

CLAY PIPE

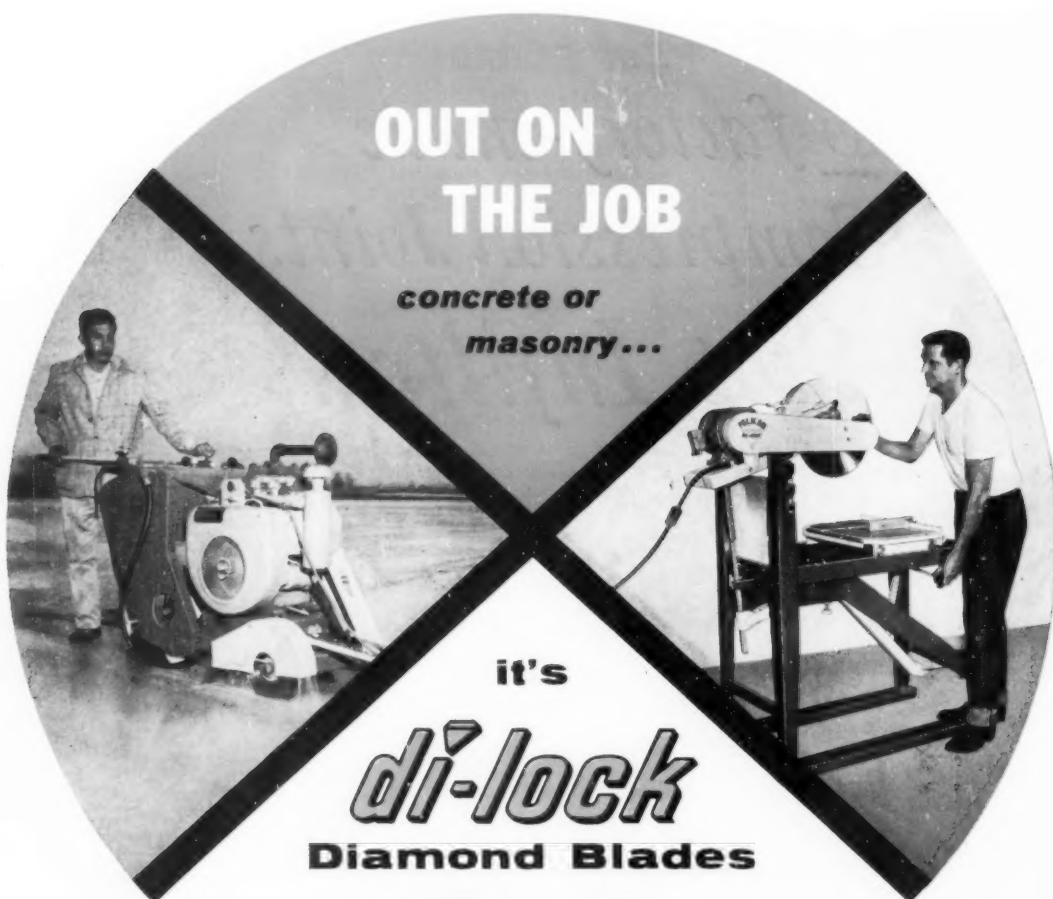
Never Wears Out

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C.
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PUBLIC WORKS for January, 1959

**OUT ON
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*concrete or
masonry...*



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Diamond Blades

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On test after test from one coast to the other, DI-LOCK stands out above all other diamond blades.

Users report "LONGER LIFE"...as much as 78% more! "FASTER CUTTING"...speed that keeps ahead of every job requirement! "MUCH LOWER COST"... based on actual number of cuts or footage produced against original blade cost!

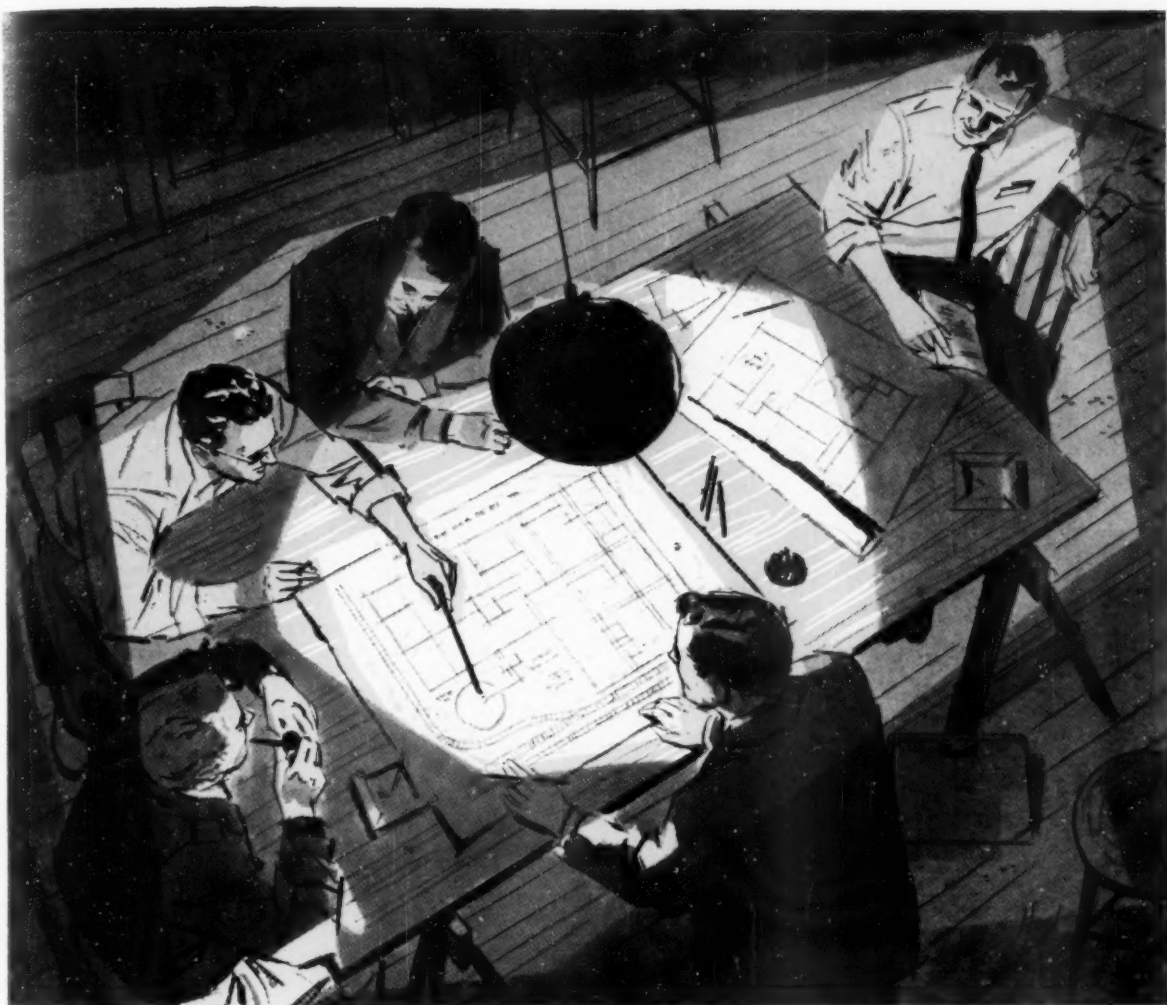
Felker DI-LOCK insures the three essentials to blade economy—*longer life, faster cutting, lower cost per cut or per foot*—by the DI-LOCK method of diamond bonding...an exclusive process that seizes each diamond particle and locks it in the segment more tightly than ever before possible!

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To order these helpful booklets, check the reply card opposite page 34.



McConnaughay HTD MIXER No. 10

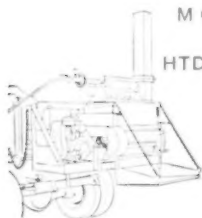
½ TON PER BATCH

No Other Asphalt Mixers Can Do All These Things So Effectively

You can use a McConnaughay Mixer to reactivate and heat stock pile mixtures... prepare cold asphaltic mixtures... prepare hot asphaltic mixtures... dry various types of wet aggregates quickly, thoroughly... remove both moisture and solvents from bituminous mixtures... produce

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HTD No. 4-T



HTD No. 5



HTD No. 8

McCONNAUGHAY MIXERS, INC.—LAFAYETTE, IND.

National distributors: Asphalt Equipment Co.
3314 Cherry Lane, Fort Wayne, Indiana

Drilling Machine For Concrete

221. The Truco diamond drilling machine is described in literature available from Truco Swivel Div., Wheel Trueing Tool Co., 15-3200 W. Davison Ave., Detroit 38, Mich. Unit will cut reinforced or plain concrete.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 155 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

Principles of "Batchomatic" Plants Explained

527. The unique principles of simultaneous and fully automatic aggregate and bitumen measuring followed on Barber-Greene's 2,000, 4,000 and 6,000 lb. "Batchomatic" bituminous batch plants are explained with cut away drawings, charts and other illustrations in a 3-color bulletin offered by Barber-Greene Co., Aurora, Ill. Check the reply card.

What You Should Know About a Motor Grader

673. Photographs, sketches and other instruction illustrations aid readers to visualize details of the Allis-Chalmers Model Forty-Five motor grader mechanical features and components. The catalog also tells about attachments and accessories. Write Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc.

Slide Rule PS1® Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

SNOW AND ICE CONTROL

Get Full Data On Aggregate Spreaders

34. Accurate control for spreading asphalt, crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on towed, truck mounted and tailgate types available by checking the reply card. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

Uniform Salt Spreading Saves Material

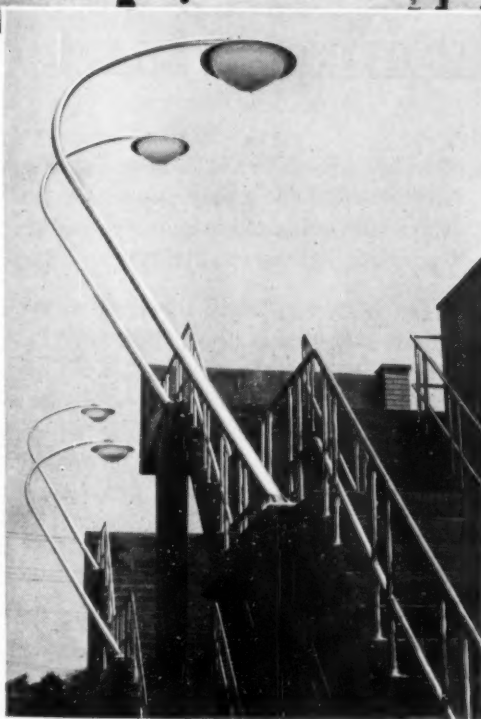
42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

RECREATION

Rubberized Playground Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the reply card or write to U. S. Rubber Reclaiming Co. Inc., Box 365, Buffalo 5, N. Y.

Yonkers new raceway picks a sure thing



Architect: Lionel K. Levy, N. Y.

Electrical Consultant: Guy P. Panero, N. Y.

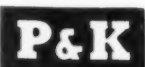
Electrical Contractor: Fischbach & Moore, Inc., N. Y.

P&K CIRCLElux DAVITS LIGHT THE WAY

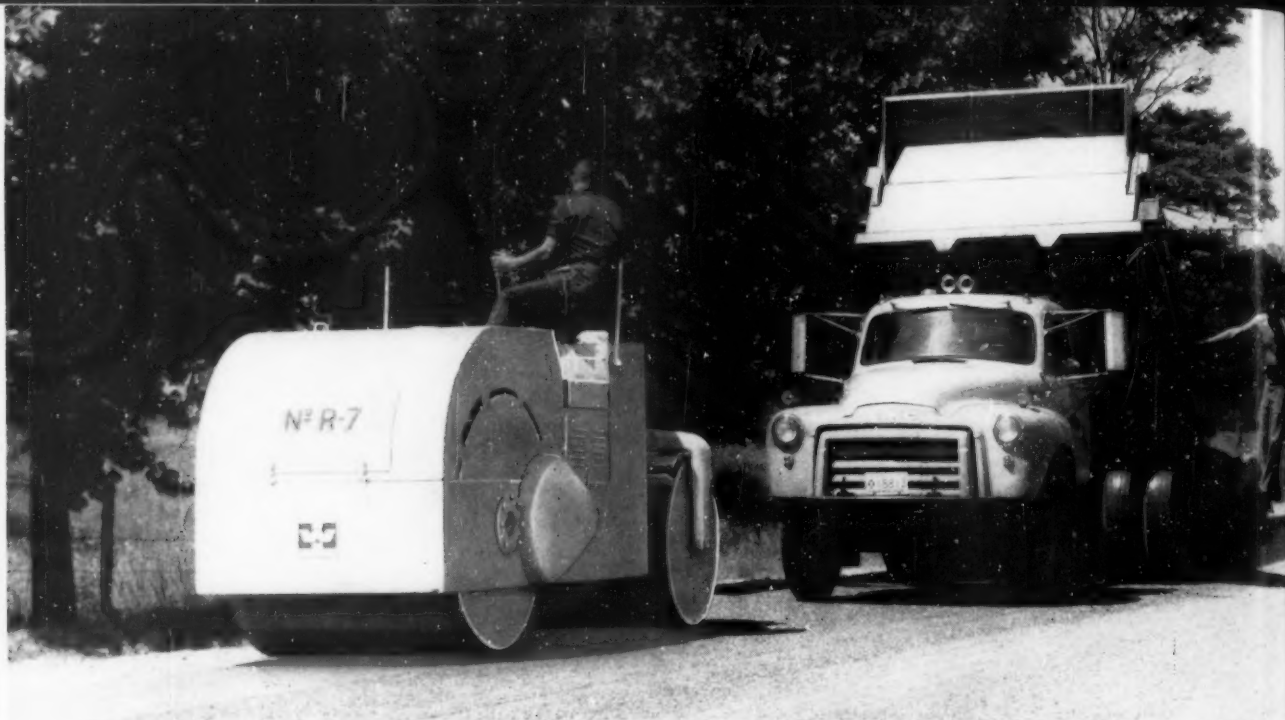
Here, at the country's newest and most luxurious track, P&K all-aluminum CIRCLElux davit-style lighting standards were chosen. Their natural functional beauty add a modern complement to the surroundings. For example, the units illustrated are 10 foot gracefully arched davits with our CIRCLElux fluorescent luminaire. CIRCLElux incandescent luminaires were used in other applications at the raceway.

The wide range of styles available, along with the choice of three lighting sources—incandescent, fluorescent, and mercury vapor—enables you to effectively customize any installation with a "package" unit, standard and luminaire, complete and ready for installation. This means easier specifying and easier installation, and it is good to know that P&K aluminum standards never require painting or other costly maintenance, keep their good looks for years and years.

For more facts send for bulletin LTG-30 describing the complete range of CIRCLElux lighting packages.



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IN CANADA: POWERLITE DEVICES, LTD., TORONTO, MONTREAL, VANCOUVER
EXPORT REPRESENTATIVE: PHILIPS EXPORT CO., NEW YORK, N. Y.



This Huber-Warco 5-8 ton tandem was used by the Kent County Road Commission of Grand Rapids, Michigan, on this 13-mile resurfacing project.

“Profit-paving” is important on

When you're working against time in getting yearly paving projects completed, you need a tandem roller you can depend on . . . one that is always ready to offer the greatest rolling efficiency.

Huber-Warco tandems, with a size range to handle any rolling job, are designed to provide this needed efficiency. They offer tandem performance, plus prolonged roller life.

These Huber-Warco tandem rollers offer a torque converter, tail-shaft governor and a 2-speed transmission for a new ease in operation. The operator simply sets the speed and the tail-shaft governor maintains it automatically, regardless of grade encountered.

A completely adjustable guide roll assembly

eliminates road “scuff” caused by looseness. An easy adjustment makes it a simple matter to keep the guide roll assembly in factory perfect alignment for the life of the roller.

Other important features of Huber-Warco tandems include: elimination of a master clutch; full hydraulic steering with variable speed adjustment; clean air cooling from the top of the roller; two completely independent braking systems; dual controls within easy reach; close curb clearance of less than two inches; anti-friction bearings and many others.

The complete Huber-Warco tandem line includes medium and large size units of 5-8, 8-10, 8-12 and 10-14 tons. In smaller rollers

Terms up to 36 months and rentals available . . . contact your Huber-Warco distributor

Huber-Warco Company

Huber-Warco on the job

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*Make sure the important
"finishing touch" is with
a Huber-Warco Tandem.*

This Huber-Warco 8-12 ton tandem handles a resurfacing assignment for the Brown County Highway Department of Green Bay, Wisconsin. The finish layer was 2½" thick.



After the old blacktop was scarified, a Huber-Warco 8-12 ton tandem handles the finish rolling for the Taylor County Highway Department, Medford, Wisconsin.



county projects

there is a 3-5 ton available as a standard unit or with a portable towing attachment; and a 4-6 ton model with retractable wheels for maximum portability.

For the important "finishing touch" to your rolling requirements, get all the "profit-paving" details of Huber-Warco Tandem Rollers. Your Huber-Warco distributor can give all specifications, and arrange for a demonstration. See him soon. He is also the man to see for terms up to 36 months and rentals.



MARION, OHIO



TANDEM ROLLERS



MOTOR GRADERS

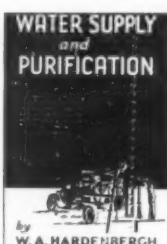


MAINTAINER



3 WHEEL ROLLERS

Books and Reprints For Your Engineering Library



Water Supply and Purification By W. A. Hardenbergh

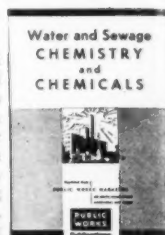
Among the major changes introduced in this latest edition are the following: The chapters on ground water, on filtration, and on laying pipe and maintaining lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up-to-date; and a new chapter has been added on fluoridation. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-1 on the coupon.

\$7.25

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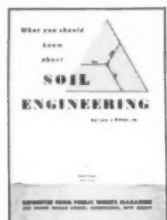
Water and Sewage Chemistry and Chemicals

If you are not an expert chemist but want a dependable text on chemistry as applied to sewerage and water works—send for this valuable reprint today. Written in plain language so anyone can understand it. Four color illustrations are used to show the exact nature of colorimetric reaction in some specific laboratory tests—something that is possible only with this type of work. Of special interest to water or sewage plant operators. To order your copy circle number A-2 on the coupon.



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A-2



What You Should Know About Soil Engineering

Soil Engineering is the practical application of engineering principles to problems involving the use of soil, either in its natural condition or as a construction material. In this authoritative booklet all phases of soil engineering are treated in simple, easily understandable language. Full information is provided on basic soil properties, classification systems, field and laboratory tests, frost action and compaction. Liberally illustrated and containing many special charts and graphs. To order your copy circle A-3 on the coupon.

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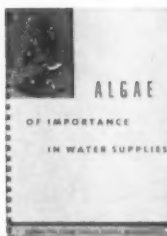
Patching Pavements Properly

Designed as a general review for the top men and a practical guide for the men in actual charge of the work. Written in down-to-earth language for easy understanding and application. Fills a long felt need for a complete and precise patching article. All types of pavements and all kinds of patching material and equipment are described and illustrated in considerable detail. Among the many subjects discussed are the general causes for failure; the various materials and equipment used in patching; and the process of making the patch. To order your copy circle number A-4.



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ALGAE of Importance in Water Supply

This major article was prepared in close collaboration with U.S. Public Health service authorities. It includes, for the first time in magazine history, full and accurate color plates for the identification of types of algae most important in water supplies—those which cause taste and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification. To order your copy circle A-5 on the coupon.

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A-5

Sewerage and Sewage Treatment

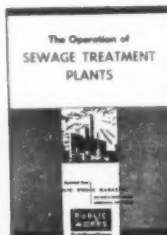
By W. A. Hardenbergh

An authoritative yet simple treatment of the subject by one of the nation's foremost authorities. Mr. Hardenbergh's editorial and field work has brought him in close contact with the problems that trouble the average engineer and in this book he explains those methods most suitable for general use. Special attention is paid to sewerage systems, both storm and sanitary. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-6 on the coupon.



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A-6



The Operation of Sewage Treatment Plants

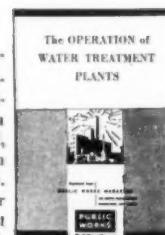
This valuable text has been completely revised, expanded and brought up to date. In it all phases of Sewage Treatment Plant operation are treated in simple, easily understandable language. Among the many subjects covered are: measurement flow; concentration and temperature; sampling sewage for analysis; laboratory determinations; purposes of treatment; operation of grit chambers; operation of screens; trickling filter operation; filter fly control; disposal of sludge; etc. To order your copy circle A-7 on the coupon.

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A-7

The Operation of Water Treatment Plants

Here in one place you have the basic information concerning all phases of plant operation. Even those without previous technical school education will find it easy to learn from this valuable text. Completely revised, expanded and brought up to date by Clayton H. Billings, Associate Editor of Public Works. This reprint is of special interest to Water Works Superintendents, Water Treatment Plant Operators and everyone connected with the Water Works field. To order your copy circle A-8 on the coupon.



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project where superior durability
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Below: Route 5, approximately 5 miles east of
Erie. Pennsylvania State Highway Department.
Contractor: Geo. S. Mellert-Weidner Co.

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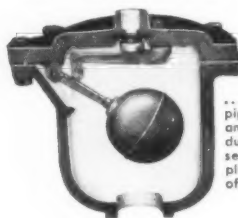
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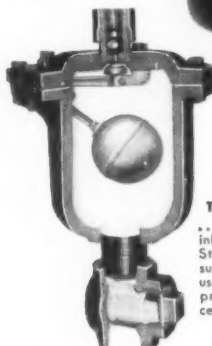
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MELVIN NORD, Dr. Eng. Sci., LL.B.

Icy Highways

Towey v. State of New York, 175 N.Y. Supp. (2d) 969, a New York case decided June 25, 1958, was an action against the State of New York for damages sustained by occupants of an automobile who were injured when it skidded on an icy highway.

On December 22, 1951, at 7:15 P.M., Lavina Towey was riding in an automobile driven by Mary Louise Towey, on Route 172 in New York State. Route 172 is a two-lane concrete roadway, with shoulders on each side about 3 feet wide. At the far end of each shoulder there was a drainage ditch of varying depth. The road is generally hilly. At the point of the road involved here, there was an apex or crown, over which the Toweys could not see. Just as they passed over this knoll on the road, their car skidded on an icy surface which had been formed on their side of the road, and which they could not have seen earlier. The car skidded first to the right and hit a pole, then it rebounded and skidded across the road to the other side.

For 5 days previously, the weather had been very fickle, varying from a minimum of 3° on December 17 to a maximum of 55° on December 21. On December 22, the date of the accident, the weather varied from 28° to 48°. Relatively heavy rains occurred on December 19 and 21. At the time of the accident there was frost in the ground. The weather was cold, dry, and clear. There was no ice on the pavement of the road other than at the location of the accident, which ice extended down the incline of the road at various widths for some 300 feet. This icy formation was caused by water bubbling out of the ground through an opening as thick as a man's thumb at a point where the pavement and the shoulders met. This water had run onto the pavement and been spread out for some 300 feet, by

being splashed about by the movement of passing vehicles.

In the course of time, sand which had been laid on the road at various periods, together with other accumulations, had been added upon the shoulder, which was now at least two inches higher than the pavement.

The roads of that district had been sanded each day from Dec. 17 to Dec. 22. Nine men worked from 9 hours to 16½ hours during these days at sanding the roads and removing water from the roads.

There was no evidence as to whether this particular piece of road had been sanded during the past few days.

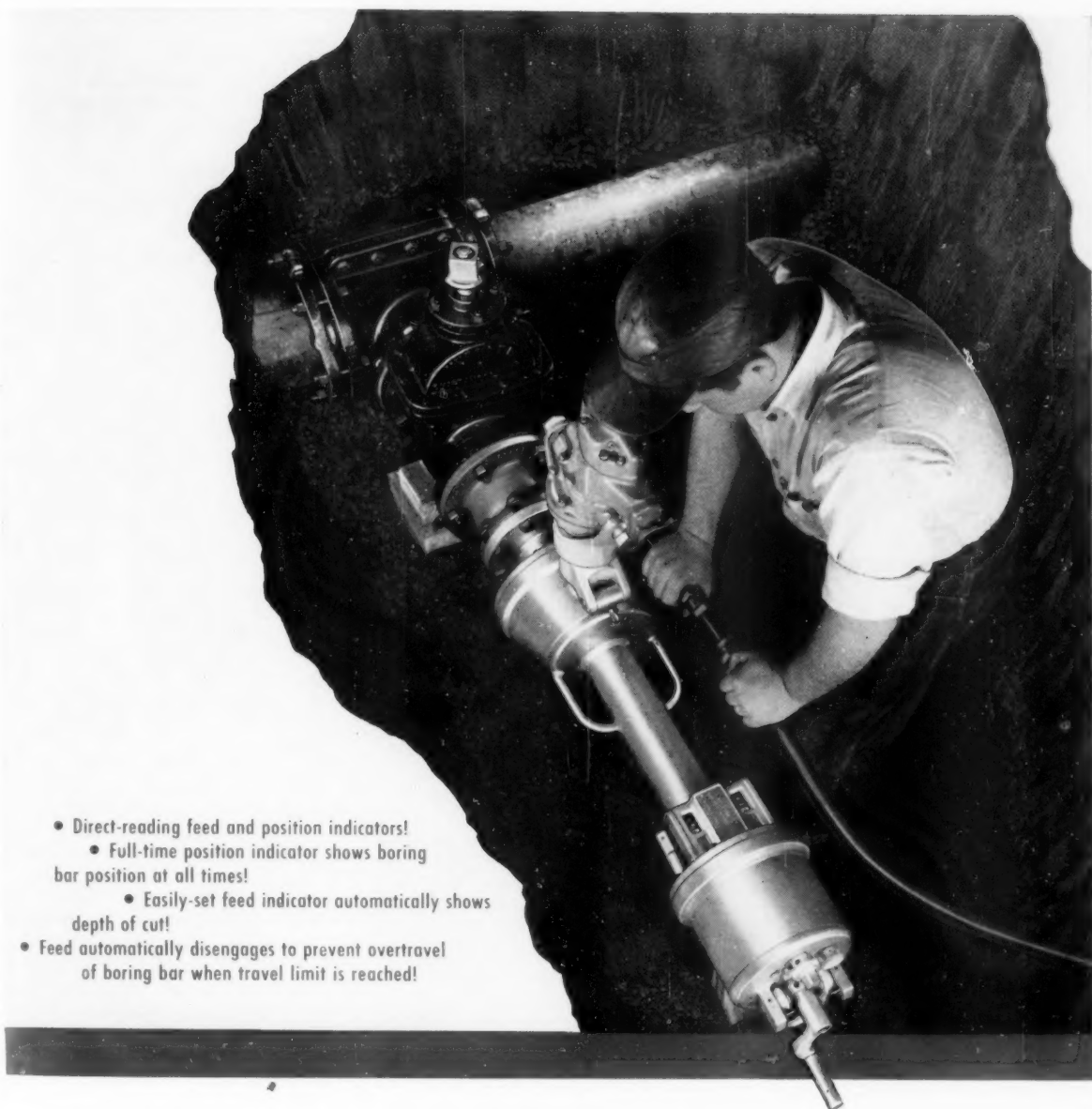
Soon after the accident, State employees, upon being notified, came upon the scene of the accident and sanded the icy area. They also cut a lateral trench in the shoulder where the water was bubbling out, taking the water directly into the drainage ditch, so that no more water flowed onto the roadway.

It was held that the State had been negligent in maintaining the highway in an unsafe condition. The court said that the exercise of reasonable prudence would have indicated to the State's employees in charge of the highway that causing the shoulder to be made higher than the surface of the pavement would naturally result in waters flowing on the surface of the highway instead of into the drainage ditch.

Judgments of \$500 and \$3500 were thus granted for the personal injuries of the two motorists.

Advertisements on Parking Meters

Winkenwerder v. City of Yakima, 328 Pac. (2d) 873, a Washington case decided July 24, 1958, was an action by a retail hardware and appliance dealer and a publishing company owning property abutting on streets where city parking meters



- Direct-reading feed and position indicators!
 - Full-time position indicator shows boring bar position at all times!
 - Easily-set feed indicator automatically shows depth of cut!
- Feed automatically disengages to prevent overtravel of boring bar when travel limit is reached!

Now! automatic cuts up to 12" with the
NEW MUELLER® CL-12
Machine!

New design and new features give automatic operation for faster, safer cuts; more strength for reduced maintenance; simplified operation for use by inexperienced personnel; more compact for easier handling; and standardized tools for simpler tool selection.

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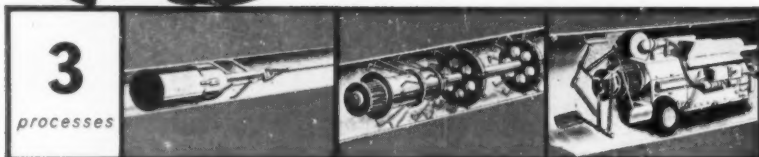
WHETHER BIG,

OR VERY SMALL...



PIPE LININGS MEN CAN FIX THEM ALL

Yes, Sir! Rehabilitation of weak, corroded and leaky pipe lines has been our business for many years. We repair pipe interiors with cement mortar lining...all the way up from four inches to as big as 144 inches. And mostly, this rehabilitation is done "in place," underground.



3

processes

THE TATE PROCESS

is for pipe diameters from 4" to 16" and is done, "in place," after by-pass lines are set up to carry on with water service.

First, the pipe is scraped and cleaned. Then, cement mortar is fed in and applied under pressure to a compact thickness of 3/16" to 1/4" giving the final effect of one continuous, cement mortar lined tube.

THE SPUNLINE PROCESS

is partly TATE and partly centrifugal, developed to provide a thin lining for preventing corrosion and to restore hydraulic flow, particularly in cast iron pipe. The cement mortar lining can go through bends and past openings. It can be applied "in place." Uninterrupted continuity is obtained.

CENTRILINE Centrifugal

Process. Cement mortar lining ingredients are mixed to rigid requirements and applied under a high velocity spray with uniform speed. Rotating steel trowels spread the mortar to a smooth, hard finish. Pipe sizes vary from 16" on up to 144". Clay, cement, brick, steel, cast iron and wrought iron pipes may be CENTRILINE.

plus SOMASTIC®

outside pipe coating which may be applied either at the central Wilmington, California, plant, or at railhead plants elsewhere.

PIPE LININGS

A Division of
American Pipe and Construction Co.

Write, Wire or Phone

2414 East 223rd Street, Wilmington, California • P.O. Box 457

Phones: NEVada 6-1771 — TErMinal 5-8201

Rail Address: Pacific Electric, Watson, California

with advertising signs had been installed, seeking to have the ordinance permitting such advertising declared unconstitutional.

In accordance with the ordinance, the City of Yakima had entered into a contract with the Meter Advertising Co., allowing the use of advertising signs in 500 meters during a 6-month trial period. The company agreed to pay \$1 per month per sign. The company agreed not to interfere with the primary use of the meter for regulation of parking. The following types of advertisements were forbidden, by the terms of the contract: signs advertising beer, wine, or liquor; signs containing vulgar, distasteful, or obscene matter; sectarian religious advertising; political advertising, except in equal amounts to each party and candidate; and signs advertising the business of a competitor, within a half-block of a competing business establishment.

The Supreme Court of Washington held without dissent that the City had not acted in an unconstitutional manner, and that the ordinance was valid. There was no encroachment against the public's rights, and no injury to the public.

A Bent Stop Sign

Skaggs v. General Electric Co., 328 Pac. (2d) 871, a Washington case decided August 21, 1958, was an action against General Electric Corporation as having control, operation, and management of the village of Richmond, Washington, for injuries sustained by the plaintiff at 4 PM when he tripped and fell over a signpost which had been bent across the sidewalk at 9 AM on the same day, when an unidentified motorist backed his automobile into it. The plaintiff obtained a judgment in the trial court based on the defendant's negligence in failing to repair or remove the sign. On appeal, The Supreme Court of Washington held as follows:

(1) Whether or not there was sufficient time for the corporation to have discovered the defect was a proper question for the jury to have decided; and

(2) It cannot be said that the plaintiff was contributorily negligent as a matter of law. That, too, was a proper question for the jury to decide. The evidence showed that the plaintiff had been momentarily distracted by the blowing horn of a passing automobile, when he tripped over the sign. The jury could properly find the defendant negligent and the plaintiff not contributorily negligent.

"Paragon:
a model or pattern;
a type of excellence
or perfection."

Webster's
New International Dictionary



In Transits too, K&E Paragon sets the pattern of perfection

The superior optical qualities and precision operation which K&E builds into the Paragon Transit® are designed to last a lifetime and offer the maximum in performance and ease of use. Compare the Paragon with other transits, feature by feature. Only the K&E Paragon Transit has all five of these important advantages:

1. A Completely Enclosed Achromatic Telescope... with an achromatic eyepiece as well as an achromatic objective lens. It sights clearly and sharply, with less eye strain. Enclosed telescope is

fully sealed, stays free from dust and moisture.

2. Chrome Plated Draw Tube... with one of the hardest bearing surfaces known to man. Tube cannot wear as it moves back and forth on bearing rings, so line of sight remains stable.

3. Stainless Steel Axle Journals... for the best possible bearing surface. Ease of operation is retained no matter how many times you change the telescope from the direct to the reverse position.

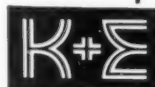
4. One-Piece Spanned Vernier Disc... to make sure that the verniers always

stay exactly 180 degrees apart. Even under the roughest, most demanding field conditions, angle readings of the Paragon Transit will stay true.

5. Chrome Plated Center... combines the toughness of non-brittle forged Everdur with the hardness of chrome.

Naturally, because the K&E Paragon Transit is the best, it costs a little more than ordinary transits. But see for yourself how much more it has to offer. A call to your K&E representative will quickly arrange for a demonstration. Fill out and send in the coupon below.

1612



KEUFFEL & ESSER CO. Dept. PW-1 Hoboken, N. J.

Gentlemen: ☐ Please have a K&E representative show me the K&E Paragon Transit.
☐ Please send me more information about the K&E Paragon Transit.

Name & Title _____

Company & Address _____



Job-sized and budget matched . . . NEW INTERNATIONAL UTILITY TRACTORS

Only the new International power line—with 6 sizes of wheel tractors from 12.8 to 90 hp*—offers you a specific power-match for each of your particular types of jobs . . . assuring the maximum in performance from your equipment budget.

Ask your IH dealer to demonstrate . . . or write for his name and new specification catalog. International Harvester Company, Dept. PW-1.P. O. Box 7333, Chicago 80, Illinois.



*Bare engine horsepower at standard sea level conditions

**SEE YOUR
INTERNATIONAL
HARVESTER DEALER**

International Harvester Company Products pay for themselves in use—Farm Tractors and Equipment . . . Twine . . . Commercial Wheel Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois

12.8 hp International® Cub® Lo-Boy® is your lowest-cost power buy for all-around utility. Cub Lo-Boy mows equally well with 3-gang mower . . . rotary or cutter bar mower . . . Hammer Knife mower. Year 'round utility with loader, blade, others.

Rotary mower: Wood Bros.



61 hp International 460 Utility with smooth six-cylinder power—gasoline, Diesel, or LP Gas. Provides top capacity for loading and trenching with International Pippin and International Wagner (shown) heavy-duty backhoes and loaders.



Cutter bar mower, IH . . . Loader: International Wagner

45 hp International 340 Utility combines brawn for heavy work with exceptional operating economy. Front-end loader and side-mounted cutter bar mower represent only one of the many equipment combinations available for this versatile power unit.

38.5 hp International 240 Utility, new IH power size, provides International durability and brawn matched to the lighter range of work. The 240 proves especially economical for mowing, utility loading, trenching to 10-foot depths, landscaping.

7-gang mower: Roseman



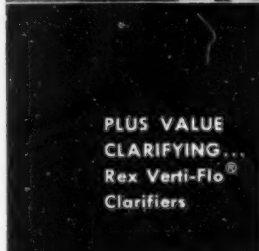
**PLUS VALUE
SCREENING
REMOVAL...**
Rex Front Cleaning
Bar Screens



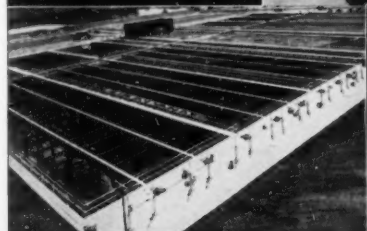
**PLUS VALUE
GRIT REMOVAL...**
Rex Grit Collectors
with recirculation
for conditioning



**PLUS VALUE
CLARIFYING...**
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Clarifiers



**PLUS VALUE
SLUDGE REMOVAL**
... Rex Conveyor
Sludge Collectors



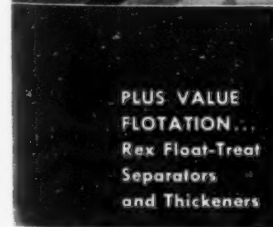
**PLUS VALUE
SLUDGE REMOVAL...**
Rex Unitube Tow-Bro®
Sludge Removers



**PLUS VALUE
SKIMMING...**
Rex Skimming
Equipment



**PLUS VALUE
FLOTATION...**
Rex Float-Treat
Separators
and Thickeners



for **PLUS** value
PERFORMANCE...



**sewage and waste
treatment equipment**

What are the *plus values* you get in Rex Sewage and Waste Treatment Equipment that mean more efficient plant performance...lower operating and maintenance costs?

FIRST...dependability! Years of practical experience, a broad background of engineering knowledge, manufacturing skill, and the modern equipment that translates these into quality products combine to assure dependable operation under any condition.

SECOND...efficiency! Continuous research, product development and improvement...important pioneering in developing new methods and equipment to meet today's needs...add up to proven equipment that assures unequaled efficiency in performance.

THIRD...economy! Rex engineering leadership and modern manufacturing techniques make possible equipment that is less costly to install, easier to operate and maintain...over-all operating economy during the entire lifetime of the equipment.

FOURTH...flexibility! The broad line of Rex Equipment offers you the widest choice of equipment. There is a type and size to exactly suit the requirement. No need to buy more than you need...no need to take less than you want.

For complete data on the *plus values* in Rex Equipment, write CHAIN Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wisconsin.

**CHAIN
BELT**



REFUSE COLLECTION PRACTICE

This book, prepared by the Committee on Refuse Collection of the American Public Works Association, is a practical manual covering the many facets of the problem—the kinds and amounts of community refuse materials and their preparation for collection; costs, methods, and equipment; planning the collection systems; municipal, contract, or private collection; and the management problems of financing, organization, personnel, equipment management, reporting, cost accounting, budgeting and public relations. The Committee on Refuse Collection first gathered data on the practices of more than 900 cities of over 5,000 population throughout the United States and Canada. It then forwarded a detailed questionnaire

to 125 cities selected by the members of the Committee as able to provide the most accurate and complete information on operations, quantity and costs. Of this group, 89 cities responded, ranging in population from 13,000 to over 8,000,000. The U. S. Public Health Service cooperated in the preparation of the book through provision of technical assistance, particularly in the tabulation and analysis of the data contained in the returned questionnaires. Published by Public Administration Service, 1313 East 60th St., Chicago 37, Ill., this fully illustrated, 562-page book is \$8 per copy.

DRIVER CHARACTERISTICS AND BEHAVIOR STUDIES

This bulletin includes six papers on driver characteristics and behavior studies as presented at the 36th Annual Meeting of the Highway Research Board, as follows: Development of a Criterion for Driving Performance, by A. R. Lauer and Virtus W. Suhr; A Factor Study on Drivers' Attitudes, with Further Study on Driver Aggression, by Leon G. Goldstein and James N. Mosel; Development of a Driving Attitude Scale, by Harry W. Case and Roger G. Stewart;

Community Study of the Characteristics of Drivers and Driver Behavior Related to Accident Experience, by C. E. Billion; Situational Characteristics and Turn-Signalling Behavior, by Abram M. Barch, John Nangle and Don Trumbo; and Turn Signals for Motor Vehicles, by R. L. Moore, A. Crawford and P. Odescalchi. Copies at \$2.40 each are available from Highway Research Board, 2101 Constitution, Washington, D. C.

CONSTRUCTION ACCOUNTING AND FINANCIAL MANAGEMENT

This 481-page book describes and specifically recommends proper accounting and management procedures. It relates them to the company's other functions in such a way that the means of getting productive financial control in every operation are clearly evident. The work is written in terms that can be understood and immediately applied by any operational manager, as well as accountants and financial personnel. The author is William E. Coombs, Secretary and Treasurer of Match Corp., general contractors specializing in heavy engineering construction. Copies are \$12.85 each and are available from F. W. Dodge Corp., 119 West 40th St., New York 18, N. Y.

SOUND QUALITY • SUPERIOR FINISH • SOLID VALUE

CONSTRUCTION CASTINGS

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Patterns on hand for over 15,000 different Gray Iron and Ductile Iron construction castings.

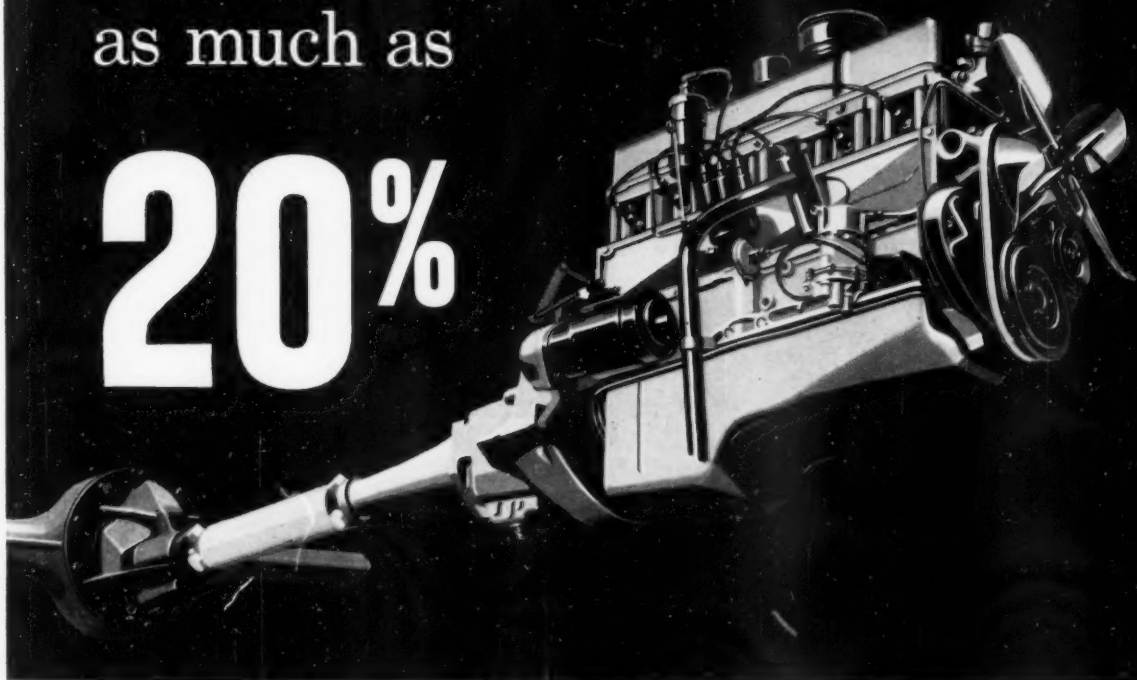
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With new features and options,
'59 Chevrolet truck 6 boosts
fuel economy by
as much as

20%



A new camshaft design and a new maximum-economy option* bring you this remarkable increase in gas savings with Chevy's Thriftmaster 6.†

This newly improved engine for '59 offers fuel economy that can mean up to one dollar saved out of every five spent for gas! Its outstanding gas-saving ability stems from two new engineering refinements.

The first is an *economy-contoured camshaft* that's machined to provide a lower lift and reduced valve overlap. This feature offers

up to 10% less fuel consumption in every '59 Chevy Series 30 or 40 model with standard Thriftmaster 6!

The second innovation is a new *maximum-economy option* that operates in combination with the economy-contoured camshaft in Series 31 and 32 models. Consisting of a new smaller venturi carburetor and new economy ratio rear axle, this option boosts fuel economy as much as an additional 10%! Thus, Series 31 and 32 Chevies with the new Thriftmaster 6 can be equipped to reduce your operating costs by up to 20%!

This is the kind of low-cost truck power you've been looking for—so see your Chevy dealer soon for all the details! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

*Optional at extra cost.

†And it uses regular gas, like all Chevy engines.

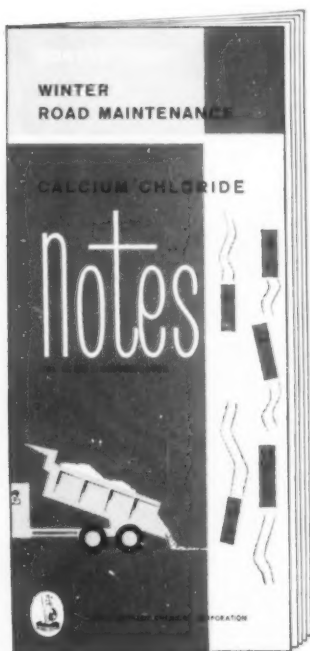
CHEVROLET TASK-FORCE 59 TRUCKS



"why should I use calcium chloride-rock salt mixtures for ice control?"

The advantages are outstanding . . .

Effective—at *all* temperatures • **Faster Melting**—calcium chloride triggers action of the rock salt • **Easily Stored**—in the open under tarpaulin or sheds • **Economical**—greatly increased effectiveness with little increase in cost • **Adaptable**—to bulk shipments of both calcium chloride and rock salt • **Best Way**—to maintain bare pavements



This new booklet contains the latest information including: why mixtures work better • how and in what percentages to store • mixing methods • recommendations for various storm conditions

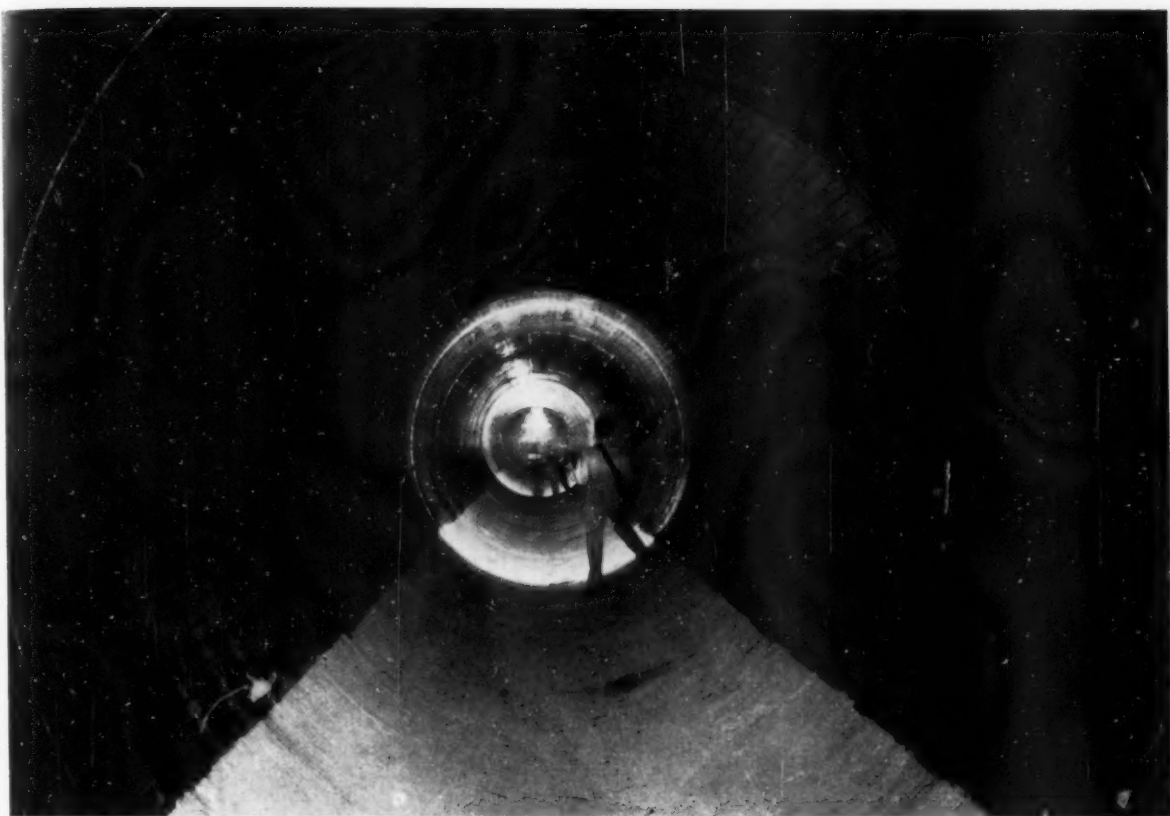
WRITE TODAY for the assistance you desire

- ☐ Please send me free booklet
- ☐ Information on mixtures
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112

This Sewer will go a Long Way

Not only will this 9½-foot outfall sewer extend eight miles, but it will go a long way in years of trouble-free service. The engineers who designed it say that it will still be functioning perfectly in the year 2000.

Their confidence is based on wise choice of construction materials. Every joint of pipe, every foot of monolithic tunnel, every structure is built of reinforced concrete to obtain structural strength at low cost. Every surface above the low flow line is completely covered by a continuous membrane of T-Lock Amer-Plate®, the vinyl lining that is impervious to the corrosive action of oxidized hydrogen sulfide at any level of concentration.

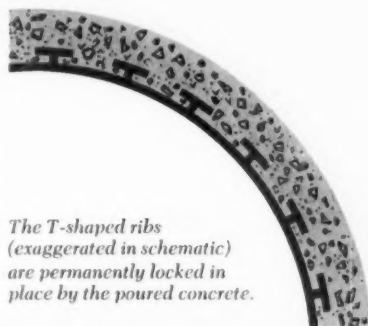
The engineers know that no one can accurately predict future rates of H₂S gas generation, so they have insured the ultimate life of the concrete by investing an extra 8 to 10% for T-Lock protection. They predict that this "extra" will spare their city the cost of a replacement sewer in about 20 years, and save the taxpayers millions of dollars!

Because of obvious and substantial savings such as this, millions of square feet of T-Lock are now in use in progressive municipalities from coast to coast. These include Los Angeles; Topeka; Wichita; Sioux Falls; Shreveport; Washington, D.C.; San Diego; Mansfield, Ohio; Huntington, W.Va.; Hutchinson, Kan.; and Orange County, Calif. T-Lock Amer-Plate is also on current specifications for many other municipalities. For complete list of users and specifiers, plus technical data and a typical specification, write:



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The T-shaped ribs (exaggerated in schematic) are permanently locked in place by the poured concrete.



There is no limitation on size or shape of structures which may be protected with T-Lock Amer-Plate.

**in Swimming Pools
it costs no more
for the very best
Protection!**



**SWIMMING POOL
EQUIPMENT**

for WATER LEVEL DECK POOLS

The Water Level Deck Type Pool is a more sanitary, safer and more usable pool for all age groups, in addition to being a more economical pool.

The deck level construction permits filling the pool to a level where the bather can roll out of the water to the promenade deck, at any point, in the easy "turtle type" method, without depending on ladders, steps, ramps or other means. This method makes the Water Level Deck Type Pool very advantageous for the instruction of children, paraplegics and other handicapped bathers.

Scum is washed over the coping and out of the pool to accessible drains. The water level which is 1" below the top of the coping, eliminates hard-to-drain scum gutters above the water line and also effects a saving of cost for formed tile gutters and from 5" to 10" of excavation and concrete walls.

Send coupon below for Manual SP-6, the "authority" on swimming pool circulation and drainage. In it you will find typical plans and layouts of pools, with complete descriptions of supply fittings, gutter drains, overflows, outlets, vacuum connections, hair and sediment interceptors and other necessary fittings to meet every pool requirement.



Series No. 0291-B
Deck Trench grate



Series No. 0297-B
Skimmer grill and
access gate



Series No. 0298
Skimmer Fittings
with flow control



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Series No. 0380
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COMMENTARY on WATER and SEWAGE TREATMENT

REPLACING
CONVENTIONAL GRIT CHAMBERS

R. S. RANKIN

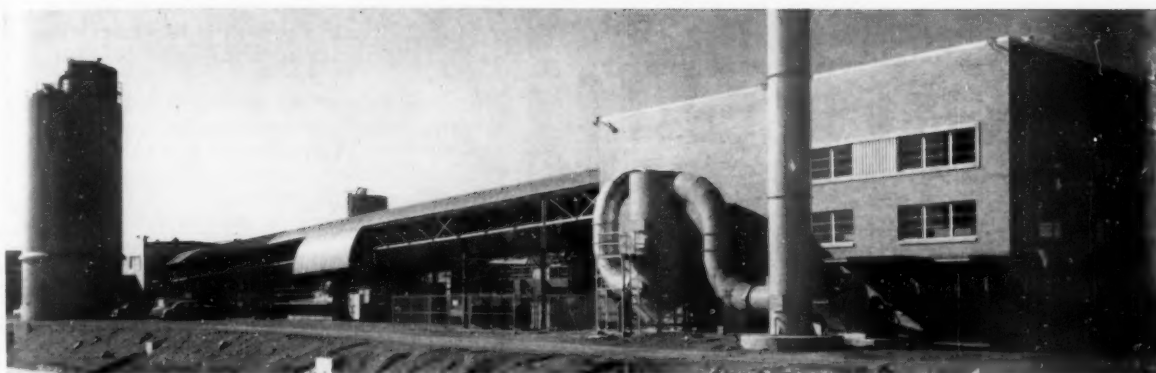
Consultant, Water and Sewage Treatment

SEPARATION and removal of grit from dilute sludge or from raw sewage by means of the hydraulic cyclone is now entirely practical, thus making it possible to omit conventional grit chambers. The entire flow of sewage can be put through the cyclone but preferably only the sludge containing the grit is passed through it. The latter method is more practical in most plants as the cyclone can be smaller and require less pumping. Furthermore the same sedimentation unit that removes settleable solids can also be used to remove grit. The grit then is separated very effectively from the sludge. This method is in actual use in full size plants and presents no unusual problems.

Removal of grit from sewage is now considered necessary in most plants, even those served by sewers which do not collect storm water. Grit chambers are usually designed to remove from the maximum flow all grit which would be retained on a 65 mesh screen. During flows less than maximum smaller size particles drop out. However, no one has yet devised a method of determining the efficiency of a grit chamber in terms of amount removed compared with the amount received in the raw sewage. As a result, the performance of the grit chamber is measured by the quality of the grit and not by the percentage removed as is common in other plant units.

Regardless of efficiency, most operators know that a considerable amount of grit does pass on to the settling tanks and ends up in the digester where it takes up costly space. In attempting to correct this defect, the grit chamber, whether plain or mechanized, is probably subject to the widest variety of designs of any element in a plant. Most designers as well as plant operators also will probably agree that it is the least satisfactory unit in the plant. Any alternative which can correct, overcome, or eliminate this headache producing element should be welcome.

The alternative here discussed consists in passing all sewage after screening into the sedimentation units and separating the grit from the sludge. The sludge must be in a dilute state, not over 1.0 percent solids and preferably less to enable the cyclone to separate the grit. Also, the degritted sludge will need to be thickened before it is pumped to the digester. The dilute sludge is pumped through the hydraulic cyclone at a minimum rate of 175 GPM and at an inlet pressure of 5 lb. per sq. in. (11.5 ft. head). Approximately all this pressure is lost in passage through the cyclone to effect the separation of the grit from



at City of Dayton —

self-amortizing lime recovery plant designed around Magnetic Flow Meters

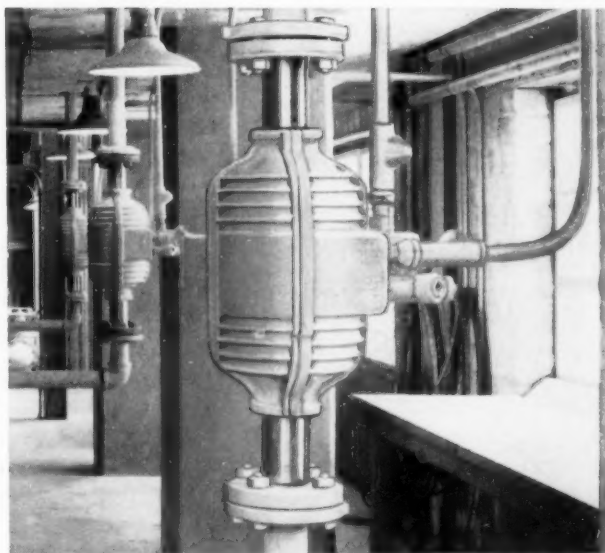
Up to 150 tons of lime a day can be recovered by Dayton's Lime Recalcining Plant. City expects to get its \$1,330,000 plant investment back in 20 years — plus a surplus estimated in the millions. Consulting Engineers: Black & Associates, Gainesville, Florida.

Dayton, Ohio's million dollar lime recalcining plant would warm the cockles of the thriftiest Scotsman's heart. Designed to recover lime used in softening city water, the plant actually recovers up to 20% more lime than originally added, with additional capacity to process most of the lime sludge accumulated over the last 5 years! City plans to sell the overage — recover its investment in short order.

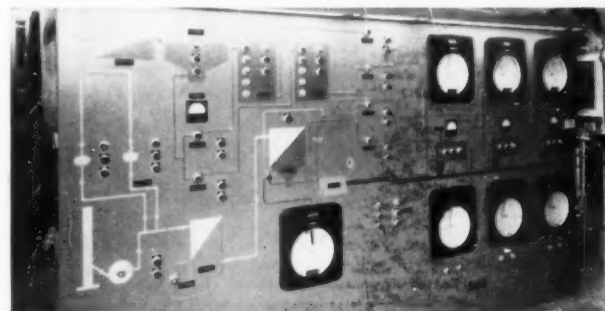
Dayton's Lime Recalcining Plant was designed around Foxboro Magnetic Flow Meters. Sludge, which would foul-up conventional head-loss devices, is easily measured since these unique meters have no flow restrictions. Measurement is instantaneous—continuous—linear. Rate of flow to centrifuges can be controlled exactly.

Maintenance on the Magnetic Flow Meter is practically nil. There are no pressure taps to get plugged or frozen . . . no seals or purges . . . no moving parts to foul.

For practically any liquid, however "difficult", you'll find the Foxboro Magnetic Flow Meter a sound investment. Find out about this fabulous instrument today. Ask your Foxboro Field Engineer for details, or write for Bulletin 20-14C. The Foxboro Company, 261 Norfolk Street, Foxboro, Mass.



Three Foxboro Magnetic Flow Meters record and control the flow of sludge to centrifuges at Dayton's Lime Recalcining Plant. Meters cannot plug up because they have no flow restrictions.



"Graphic control panel in Feed End Building is helpful in breaking in new operators and in explaining the operation to visitors," reports Plant Supt. Robert C. Stout.

FOXBORO
REG. U.S. PAT. OFF.
**MAGNETIC
FLOW METERS**

For The Best Connection You'll Ever Make—

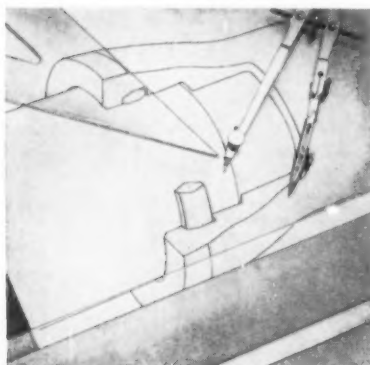
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Efficient, Economical and Fool Proof—



The **ALTITE JOINT** has been subjected to a series of rigid tests much more severe than are encountered under the most extreme installation and service conditions in the field. Even under extreme conditions, this joint is so simple to install—you could hardly go wrong if you tried.



Underwriters Approved
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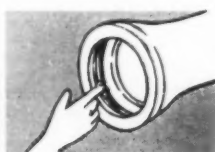
For efficiency,
Economy and
Simplicity—

Order **ALTITE** For
Your Next Job

Four Operations As Simple As Falling Off a Log—



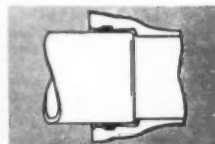
Insert Rubber gasket in bell end of pipe — you can't put it in wrong — A child can do it.



Wipe on a small amount of special lubricant—This reduces friction.



Insert plain beveled end of pipe — there are no grooves, ridges or tips on gasket to interfere with smooth insertion.



Small amount of pressure required to force plain end to bottom of socket—Your simple, time saving joint is completed.

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ALABAMA PIPE COMPANY

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the sludge. Tests indicate removals of plus 150 mesh grit with putrescible content of less than 1.5 percent which is superior in performance to most grit chambers.

The hydraulic or wet cyclone is not a new device but was introduced commercially shortly after the war. Hundreds of installations in a variety of industries provide a considerable background of experience. Entry into the sanitary field is a natural move and it needed only a cyclone designed specially to handle the miscellaneous materials in sewage which differ from the more uniform products in industry. Designs now developed have openings of ample size to pass solids in screened sewage without clogging. Operating with a centrifugal force many times gravity, the cyclone occupies but a fraction of the space used by gravity settling devices.

The effect of allowing all the grit to pass into the sedimentation unit might be questioned. Some operators will assert that much of the grit goes there anyway and a little increase will cause no more trouble. However, a few figures will illustrate the effect. Some plants report grit removals at the maximum rate of 20 cu. ft. per mil. gal. although the majority report less than 10, but these values probably do not represent all the grit. Therefore, it seems safe to assume a reasonable maximum of one cu. yd. or 27 cu. ft. of wet grit per mil. gal. When dry, grit weighs a maximum of 70 lb. and averages about 40 lb. per cu. ft. Using the maximum values for volume and weight, the increase in dry solids due to the grit entering the settling tank amounts to 230 mg/L or slightly more than the average suspended solids normally found in raw sewage.

Some existing systems with combined sewers probably exceed the rate of 27 cu. ft. of grit per mil. gal. in the raw sewage during short intervals in heavy storms. Such conditions will require careful analysis which might lead in large plants to the desirability of standby storm water tanks designed not for storage of storm water but to operate at a rate to remove only the coarser grit. Such units have been used in areas where storms are so infrequent that continuous grit removal is not justified.

Sludge removal equipment in primary clarifiers should have no difficulty in handling this increased load. Many clarifiers are probably handling it now unknowingly. The grit when mixed with sewage solids will be well lubricated and should move to the sludge outlet without difficulty. The necessary low solids concentration (1.0% or less) results in higher velocities in sludge lines and reduced chance of stoppage.

The cyclone offered by one company is designed to separate 150 mesh grit from flows of 175 to 190 GPM in a unit only 12 in. in diameter and from flows of 350 to 760 GPM in a 24-inch diameter unit. There are no moving parts in the cyclone. At a pressure of 5 lb. per sq. in. at the inlet, power requirements at 75 percent efficiency are $\frac{3}{4}$ HP for the 12-inch and up to 3 HP for the 24-inch unit both exclusive of static head. Space requirements are negligible compared to customary grit removal equipment. Clearances in the cyclone are adequate to avoid clogging from objects in sewage passed through screens with 1-inch openings. Pumps for supplying the cyclone are of the non-clog centrifugal type as reciprocating pumps are unsuited for cyclone operation due to fluctuations in discharge.

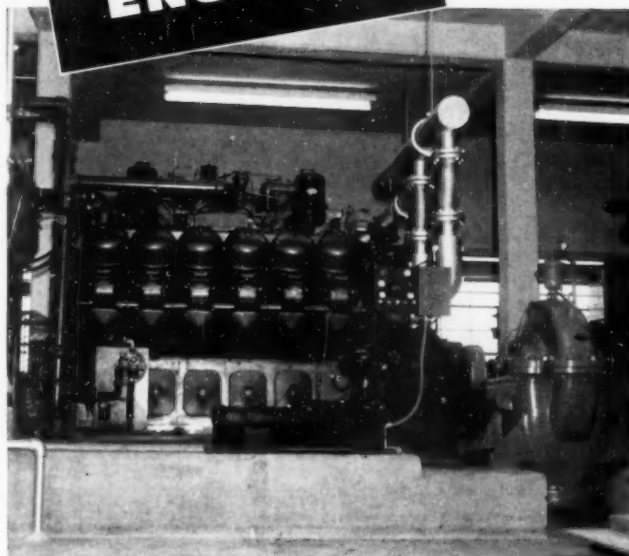
The dewatered sludge leaving the cyclone requires thickening before passing to the digester. This op-

Oklahoma City's Lake Hefner Municipal Filtration Plant

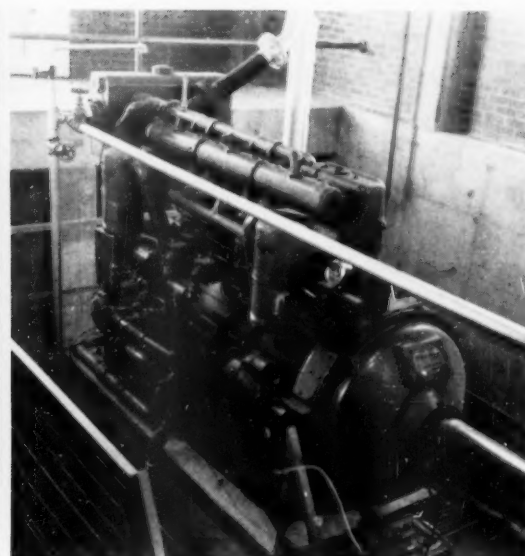


...has three
ROILINE
ENGINES

pulling the pumps



Model L-3460, max. hp 595 at 1350 rpm on natural gas



Model F-1500, max. hp 215 at 1200 rpm on natural gas

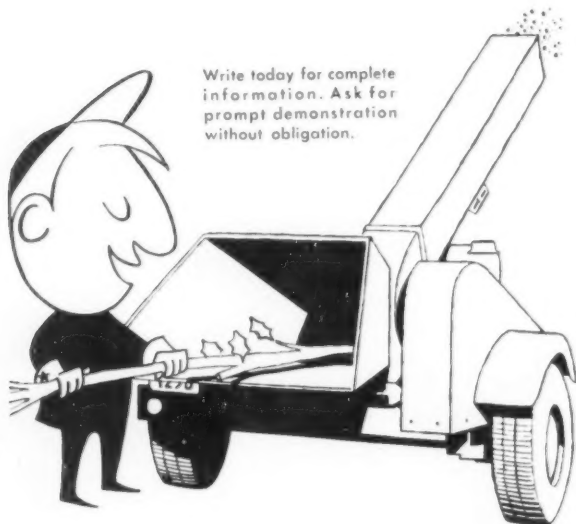
• The municipal filtration plant of Oklahoma City, Okla. at Lake Hefner has three *Roiline* engines pulling the pumps. Pictured above are two Model L-3460 *Roilines* (max. hp 595 at 1350 rpm on natural gas) each engine pulling a ten million gallon Gould pump; and a Model F-1500 *Roiline* engine (max. hp 215 at 1200 rpm on natural gas) operating a fifteen million gallon Peerless Hydrafoil at low lift pump station. In addition, but not illustrated, is a Model L-3000 *Roiline* engine driving a 250 KVA generator. The Carson Machine & Supply Co. of Oklahoma City, Okla., made the installation. Send for Bulletins.

395

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TOP SPEED—a specially designed power unit provides faster, more uniform chipping action. **ABSOLUTE SAFETY**—positive-locking, tapered blades and wedges. **BULK FEED**—a ravenous appetite for brush up to 6" diameter. **LOWER MAINTENANCE**—thanks to simplicity of design, fewer moving parts. **SUPERIOR TRACKING**—underslung engine and axle lowers center of gravity. **CUSTOM TOOL COMPARTMENT**—to protect servicing equipment. **SERVICE AND ECONOMY**—proven by the largest tree company in the world.



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505 York Road, Jenkintown, Pa.

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eration presents no problem as it falls neatly into the pattern for thickening sludges as first demonstrated by Torpey and discussed in the October, 1958, issue of *PUBLIC WORKS*. The grit discharged from the cyclone is somewhat sloppy but it is usually free draining; or where desirable, a dewatering device can be added.

The operation is simple and uncomplicated compared to the manipulation of multiple grit channels. Some modifications are necessary in smaller plants which include recycling some of the cyclone overflow back to the sludge pump suction so as to reduce the thickener feed to the volume consistent with its size and design load. Another variation to reduce the gross volume is the application of time clock control to the pump. In plants with primary and secondary treatment including sludge thickeners, the combined primary and waste secondary sludges can be passed through the cyclone. This arrangement may be applied to smaller plants where the volume of primary sludge alone is below the minimum required for the cyclone.

Future plants designed without grit chambers will be more simple to construct and show a substantial reduction in cost. The operator will have less to worry about and grit accumulations in the digester, which reduce effective capacity, will disappear.

• • •

Interstate System Advertising Standards

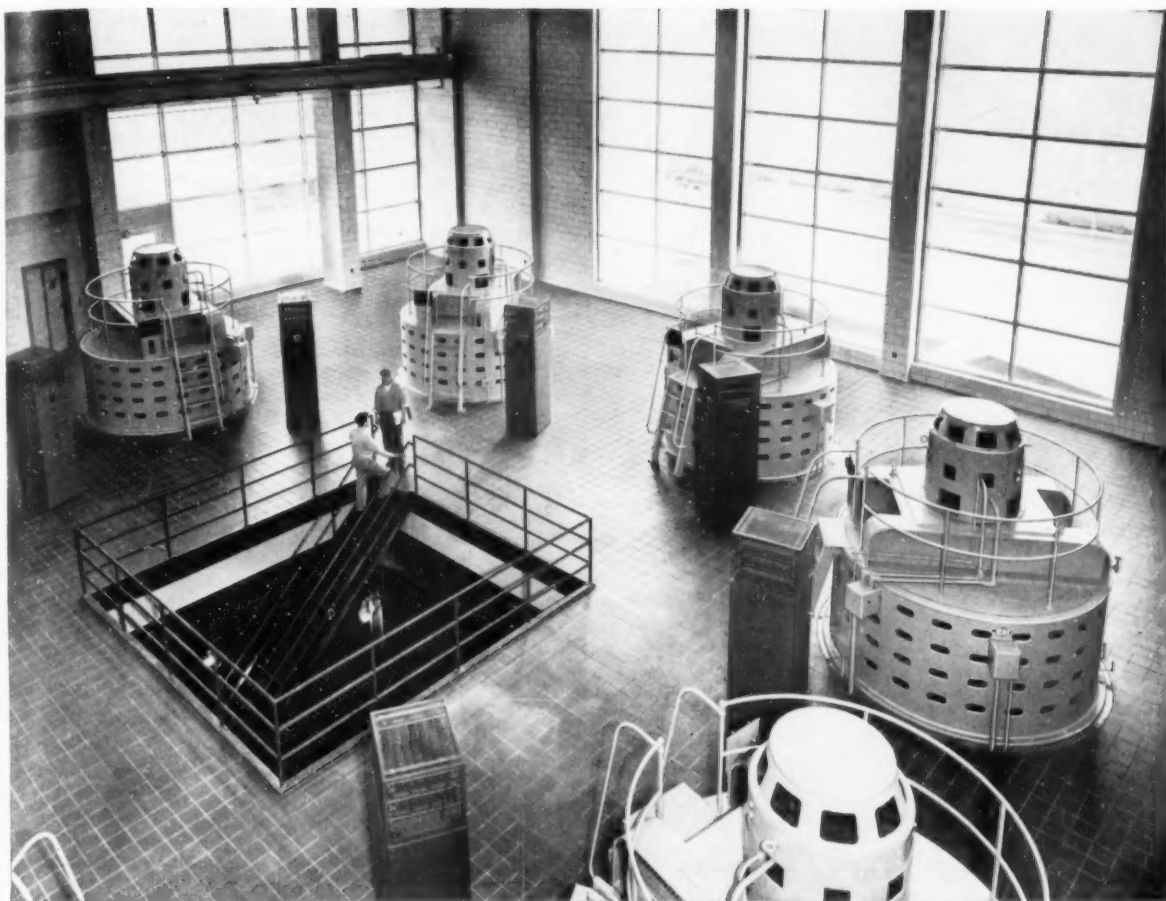
Secretary of Commerce Sinclair Weeks told the Senate Roads Subcommittee that the advertising standards for the Interstate System are completed and are ready for printing in the Federal Register. The standards would allow no advertising signs within two miles of an interchange, but in areas extending from two to five miles from interchanges, about six signs would be permitted. Beyond the five mile areas, approximately one sign per mile would be permitted. Signs also would be permitted within the interchange area.

The standards would set up informational sites or rest areas, one possibly every 12 miles where necessary, where additional signs on a large panel billboard would be permitted, advertising activities conducted within 12 miles of the sign. Certain other facilities, such as telephones, also would be permitted in these areas. The areas could be located either on or off the Interstate right-of-way, connected by access roads. Brand names would not be allowed in advertising unless they were a part of the establishment's name, but signs advertising historical sites would not be limited.

Equipment and Procedures for Sewer Lateral Installation

In a discussion on the use of Equipment (in a paper before the APWA), L. E. McCorison, Equipment Superintendent, San Diego, Calif., described the procedures for constructing house sewers or laterals as follows:

A sewer-lateral or house sewer, installation crew, as is used in the City of San Diego, is a good example of a mobile work shop group. A crew of this sort is equipped with a Crew Truck and a Compressor Truck. The Crew Truck is loaded the first thing in the morning with pipe and fittings, and small quantities of sand and cement sufficient for that day's work. It regularly carries butane tanks and burners, caulking compound, shovels, pick, bars and an assortment



Here's how Detroit got flood-busting pump power for Storm Water Sewer System

Extensive rainstorm flood damage had been a problem that 150,000 residents of the Fox Creek District of Detroit faced each year. Existing storm sewers and pumping stations were recognized as being inadequate.

To end this situation, Detroit city engineers started a long-range area program. It included the installation of a new large storm water sewer system backed up by a series of pumping stations capable of pumping an enormous quantity of water, *fast!*

Will Handle 30,000 Gallons a Second

The Freud Storm Water Pumping Station shown above is the third to be completed in the new system. Eventually this station will handle up to 30,000 gallons per second with the eight huge pumps installed there.

Eight rugged E-M Vertical Synchronous Motors and Controls are used to drive these huge pumps. Each motor develops 3000 horsepower at 225 rpm.

Here's why E-M Vertical Synchronous Motors were chosen:

1. **HIGH EFFICIENCY** conversion of electric power to mechanical power by synchronous motors . . . results in minimum electric power cost operation.
2. **UNITY POWER FACTOR OPERATION** keeps station power factor high . . . further reducing power costs.
3. **HIGH THRUST CAPACITY DESIGN** frames and bearings . . . assures long-life, trouble-free operation.
4. **ACCESSIBILITY** thru sectional frame design and convenient inspection openings . . . keeps disassembly and inspection costs at a minimum.
5. **SIMPLE STARTING** with "Conscious" Control by the E-M developed Polarized Field-Frequency Relay System.

Ask your nearest E-M sales engineer for vertical motor facts, and write the factory for E-M Synchronizer No. 43, the vertical motor issue.

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MINNEAPOLIS 13, MINNESOTA



Specialists in making motors do EXACTLY WHAT YOU WANT THEM TO

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specifications of various Hydrauger models.

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Hydrauger bored holes for pipe installation
invariably reduce costs 80% to 90% by elim-
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nothing of man-hour labor savings and
safety to highway traffic.

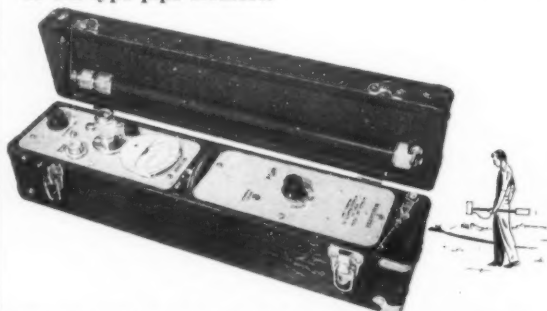
HYDRAUGER CORP. Ltd.

681 Market Street
San Francisco, California

*Earth Boring Tool

THE NEW MINIATURIZED WILKINSON LINE LOCATOR MODEL W-3

This radically new, powerful, transistorized locating
instrument weighs only 4 pounds and is 1/4 as large
as old type pipe locators.



It's as handy as a flash light. The transistors rarely,
if ever, require replacement; non-leak mercury cells
outlast old type batteries at least ten times. The in-
strument cases are molded glass fibre. The alumi-
num connecting handle telescopes to 17 inches, and
the entire instrument comes in a substantial carry-
ing case.

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SYlvan 0-4314

of other tools and supplies. While this truck is being
loaded with materials by the working foreman and
the pipelayer, the compressor truck is moved to the
first job site by the operator who is accompanied by
two laborers. Upon arrival at the job, these three
break-out and excavate a trench from the sewer
main to the property line.

When the foreman arrives with the Crew Truck,
he and the pipelayer prepare to make the connec-
tion and lay the pipe. Should the trench excavation
not be complete, they will assist the compressor
operator and the two laborers to complete the dig-
out. As soon as the excavation is complete, the com-
pressor truck and its three men will move to the
next job and the second break-out will begin. In
the meantime, the foreman and the pipe-layer re-
main at the first site to complete the connection.
These latter two will backfill the trench and puddle
the backfill material and then move to the second
job to repeat these same procedures. When the sec-
ond job excavation has been finished, the three men
with the compressor truck return to the first job
to tamp the backfill and finish up. They then move
to the third break-out to start the cycle all over
again. This "leap-frog" method of organization pro-
vides the maximum utilization of both men and
machines. It requires a certain amount of pre-plan-
ning by the Foreman, but results in all-around
effectiveness.

Cost of Laying Water Mains

The Hartford Metropolitan Water District reports
cost of laying water pipe during 1957. For complete
installation, not including overhead, by the Water
Bureau, 714.8 ft. of 6-in. cost \$6.456 per foot, includ-
ing 95 cents for labor, \$3.923 for material and \$1.583
for miscellaneous. Comparable 1956 costs were
\$4.228 per foot and 1955 costs \$6.050 per ft.

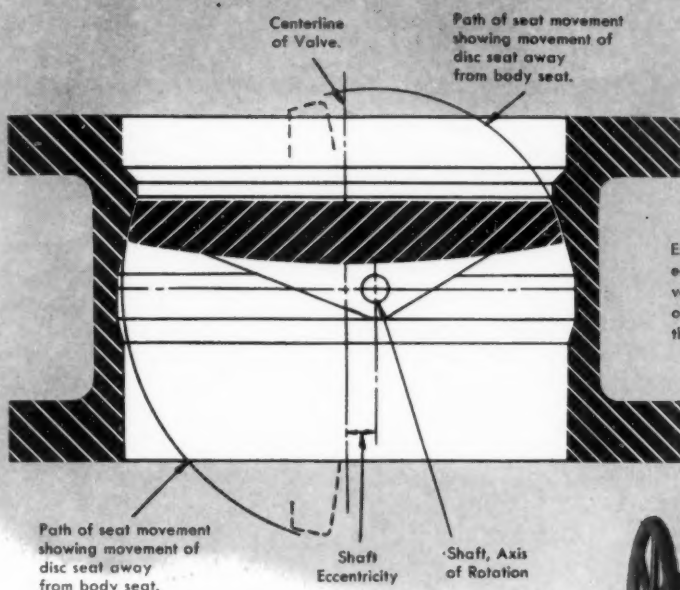
For 27,223 ft. of 8-in., cost was \$6.751 per ft., made
up of \$1.863 for labor, \$4.133 for material and 75.5
¢ for miscellaneous. In 1956, 8-in. pipe in place
cost \$5.625 and in 1955 it cost \$5.046 per foot.

For 15,073 ft. of 12-in., cost was \$8.326 per foot, of
which \$1.990 was for labor, \$6.013 for materials and
32.3 cents for miscellaneous. Comparable 1956 costs
were \$7.812 and for 1955 they were \$6.995.

For 1650 ft. of 16-in. pipe, cost per ft. was \$13.656,
of which \$2.096 was labor, \$10.513 was materials and
\$1.067 was miscellaneous. In 1956, 16-in. pipe in place
cost \$14.957 per ft., and in 1955 it cost \$10.697.

Water Consumption and Control in Australia

Water consumption in Ballarat, Australia, in 1946
was 70 gallons (Imperial) per capita; this rose to 95.5
in 1955. The Water Commission, of which A. W.
Nicholson is Chairman, assumed responsibility for
repair and renewal of service pipes between the main
and the meter during 1955. More than 200 services
were leaking continuously with the result that con-
sumption increased to 101 gpcd. Since then, the
repair of services has been expedited and more than
2,000 meters have been installed. As a result, 1957
consumption was reduced to 95 gpcd. This is con-
sidered to be excessive. Experience has shown that
until 90 percent of the services are metered, wastage
cannot be reduced to a minimum. At the close of
1957, 65 percent of the services were metered and it
was planned to install 1,000 meters during 1958. Total
water demand last year was about 2,800 million gal-
lons. Maximum daily consumption was 11.12 mg on
Jan. 31; the minimum was 3.04 mg on Aug. 25.



How **DARLING-PELTON** **BUTTERFLY VALVES**

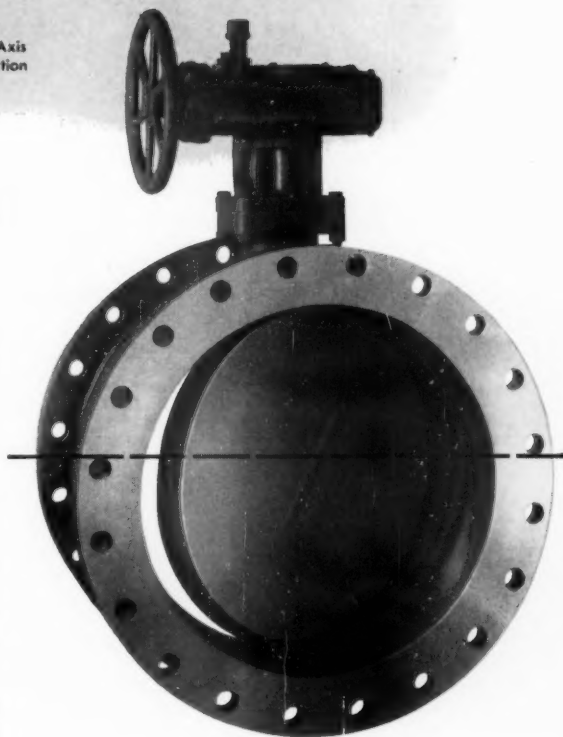
lick common problems!

Problem No. 1—COMPLETE SHUTOFF. With a continuous, 360 degree, rubber sealing ring, uninterrupted by the valve shaft, *drop-tight* shutoff becomes possible!

Problem No. 2—SEAT LIFE. With the valve disc swinging on an axis eccentric to the valve centerline, the disc lifts away from the body seat upon opening—abrasion and distortion are avoided. Moreover seat life is further prolonged by easy, compensative adjustment.

Problem No. 3—MAINTENANCE. Minimized and simplicity itself due to the unique seat ring principle. No sealing problem around the shaft. The rubber seat is replaceable in or out of the line without dismantling the valve!

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a "new twist" in lighting pole design

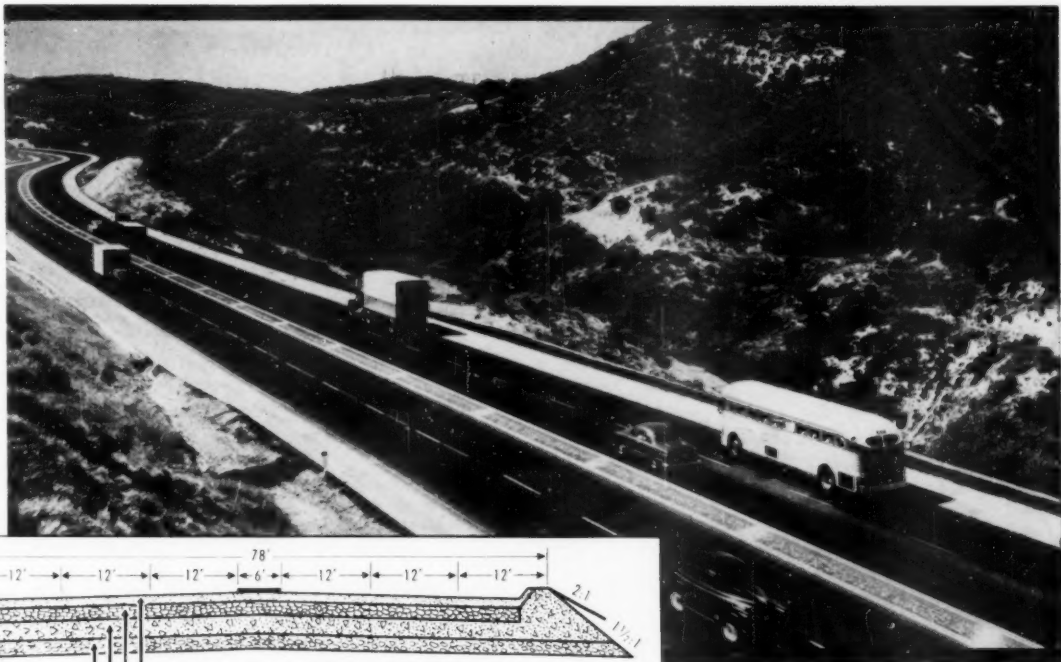
Call it tree form, futuristic, revolutionary or just plain different... it's typical of the *new* thinking in design, development and manufacture offered by Union Metal... world pioneer and leader in the manufacture of lighting poles.

**The
UNION METAL
Manufacturing Company**

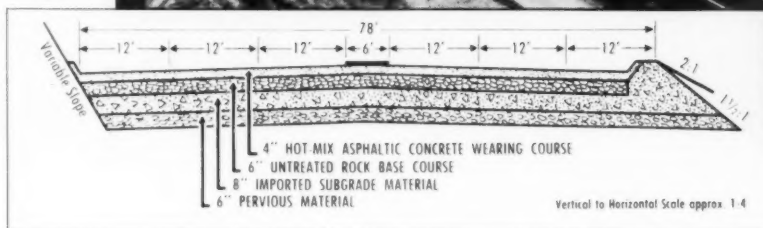
Canton 5, Ohio
Brampton, Ontario, Canada



Created for Chicago's State Street to
replace Union Metal poles installed in 1926.



● LOS ANGELES Ridge Route above; and at left a typical cross-section showing details incorporated in the design.



LOADING DESIGN FOR ASPHALT PAVEMENTS

JAMES C. JOHNSON, P.E.

Staff Engineer,
The Asphalt Institute

THE VERSATILITY of asphalt paving poses special problems in design for the road-builder who must calculate his pavement requirements in terms of volume and type of traffic. To achieve maximum value for his construction dollar, the engineer has an obligation to exploit the special economic factors that are uniquely related to asphalt engineering. These include the shrewd use of locally available materials for the lower courses or layers and the application of suitable design for the anticipated conditions.

In brief, asphalt engineering in road construction is an exercise in

engineering judgment to determine the proper pavement design. This being the case, let's examine the thickness design in closer detail.

In order to find the thickness of the individual layers and the proper total thickness of all layers there are four principal things required. These are:

1.) Traffic analysis: Determine the volume, or density, of passenger cars, buses and trucks, and the maximum single axle load for which the pavement is to be designed.

2.) Materials Analysis: Determine the load-bearing characteristics of all subgrade soils over which the asphalt pavement structure is to be built and of all materials available for use as improved subgrade, sub-base and base.

3.) Alternate Designs: Prepare alternate designs from which the final pavement section may be selected. Since a variety of materials are usually available locally which can be satisfactorily used in the construction of flexible pavements, and since there may be a choice in the type of asphalt surface to be used, alternate designs should be prepared to incorporate various combinations of these materials and pavement surfaces.

4.) Economic analysis and selection of design: After making alternate pavement designs, determine an estimated cost for each different design. Make the final selection of pavement structure by giving due consideration to all economic factors, conformance with established local



● CONSTRUCTING an asphalt paved road. At the right is a paver laying the surface; at its rear are units of compaction fleet.

practice, suitability of the surface type for the expected traffic, climatic conditions, and any other important considerations.

Traffic Analysis

Taking into account all known intentions of growth, expansion, rezoning, etc., the traffic expected on the planned roadway should be estimated as closely as possible, and allowances made for probable future traffic increases. Where vacant lots exist, or where the area is less than densely populated, expect growth along newly constructed pavements. Because of the difficulties in accurately forecasting the volume and axle-loading conditions of expected traffic, the following basis is recommended for the analysis:

- a.) Estimate the daily volume, per lane, of passenger cars and light trucks having single axle loads of 6,000 pounds or less.
- b.) Estimate the daily volume, per lane, of commercial trucks and buses having a single axle load in excess of 6,000 pounds.
- c.) Determine the maximum single axle load of commercial trucks and buses expected on the planned pavement.

It should be pointed out that we have been talking of anticipated single axle loadings. It is readily recognized that greater loadings may be carried on tandem axles. The laws of the individual states generally prescribe the allowable tandem axle loads with respect to the load permitted on a single axle. The design engineer should determine the equivalent single axle loadings from the permitted tandem axle loadings for the state, or area, in which the pavement structure is to be constructed. (What is an equivalent

single axle load in one area is not necessarily applicable to another area.) The thicknesses arrived at in this analysis will generally be satisfactory for tandem axle loading conditions allowed by the various state highway departments.

Where the pavement is being designed for two or more lanes of traffic in each direction, it should be recognized that commercial truck, bus, and generally slow traffic is normally concentrated in the outside lane. This knowledge will help the design engineer to determine the

Heavy" traffic. Asphalt pavements for parking lots should be designed for "Heavy" traffic. (When only passenger cars and light trucks of 6,000 pound axle load, or less, are expected to use a parking lot, an overall reduction in the design thickness may be made.)

Materials Analysis

There are several methods, from purely visual to those requiring laboratory tests, for the evaluation of the various soils and granular materials used in asphalt pavement construction. All of the methods now in use are considered to be empirical in nature, and no one method can be precisely correlated with another method. However, each method, when properly used, has been found to be satisfactory by numerous agencies.

In the evaluation of materials to be used in the pavement structure, the engineer must give due consideration to anticipated moisture and frost conditions, where such factors may affect the load supporting characteristics of the material. A study of the evaluation method chosen for use in designing the pavement will indicate the extent, if any, to which these factors have been taken into account in the method itself. A knowledge of local conditions and established practices in asphalt pavement design, however, is essential as a basis for judging whether a particular evaluation method properly reflects conditions which may result from moisture and frost conditions in a given locality. Where the engineer is unfamiliar with established local practices with respect to frost and moisture, it is suggested that he seeks the advice of the nearest Asphalt Institute office

Table 1—Classification of Traffic

Max. Density
per Lane per Day

Type of Traffic	Cars and Light Trucks	Heavy Trucks and Buses
Light	25	5
Medium	500	25
Heavy	Unlimited	250
Very Heavy	Unlimited	Unlimited

best number of lanes to move the traffic, or it may permit different designs for the inner and outer traffic lanes. Table 1 covers classification of traffic.

For the bus stop areas and street intersections on grades where traffic control devices such as stop lights are used, the pavement should be designed for the "Heavy" traffic classification where the normal pavement design is for "Light" or "Medium" traffic, and for "Very Heavy" traffic where the normal pavement design is for "Heavy" or "Very

or the local state highway department.

Therefore, the second step in the design of an asphalt pavement structure is the evaluation of all subgrade, improved subgrade, subbase and base materials which may be considered for use in the pavement structure.

Alternate Designs

Alternate designs of asphalt pavement sections are usually possible and economies may often be realized through their preparation and by economic analysis of each design. Alternate designs may differ in type and thickness of the pavement surface and/or in type and thickness of the various elements of base, subbase and improved subgrade materials composing the structure beneath the pavement surface. The designer must give full consideration to the various combinations of pavement and supporting materials which are likely to provide a suitable standard of performance at a minimum of cost.

In the following discussion of alternate designs, it is assumed that the data discussed earlier have been established. Alternate designs may be made by proper consideration of the following factors: a.) Total thickness of pavement structure; b.) type and thickness of pavement surface; c.) type and thickness of base; d.) type and thickness of subbase; and e.) miscellaneous design details.

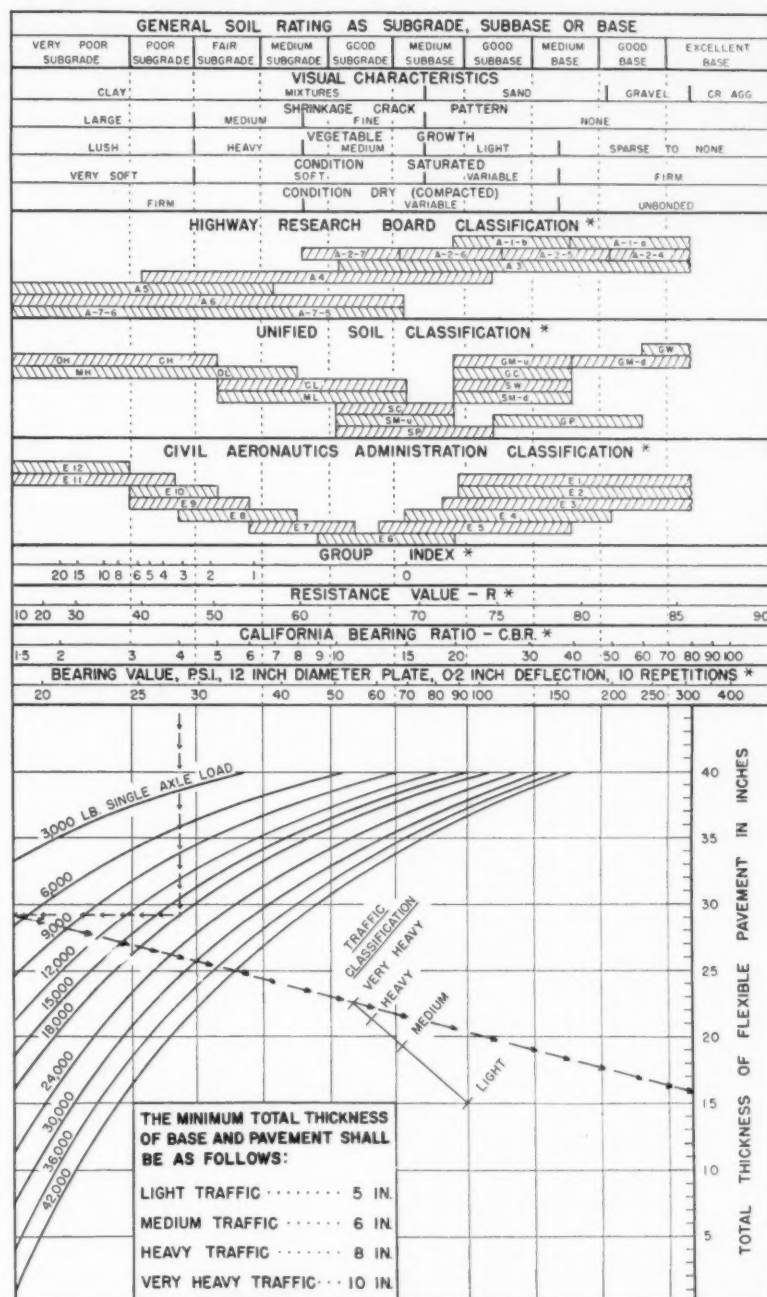
Thickness of Structure

The total thickness of an asphalt pavement structure depends primarily on the load-supporting characteristics of the native soil over which the structure is to be built. The native soil is usually designated as the "subgrade" although some prefer to use the term "basement soil." In some instances the subgrade soils may be relatively uniform throughout the limits of the project while considerable variations may be encountered in other instances. Economies may often be realized by varying the design thickness where major variations in the supporting characteristics of the subgrade soil are encountered over reasonable lengths of the expressway structure. For practical construction purposes, however, frequent changes in thickness design should be avoided.

The first step in the design of alternate sections should be a review of the test data for the subgrade soils, discussed under material analysis. The decision must then be made whether to use a single bear-

ing value for the subgrade throughout the project or to vary this value within certain limits of the project. When the subgrade bearing value (or values) has been selected, the designer may then refer to Fig. 1 to determine the required total thickness of the asphalt pavement structure. This chart is used by first locating the scale of bearing values for the test method used in evaluat-

ing the subgrade soil (e. g. Unified Soil Classification, Resistance Value —R, California Bearing Ratio—CBR, etc.) Next, the subgrade bearing value as determined by the particular evaluation method being used is located on the proper scale. Then, a line is drawn vertically downward to intersect the proper single axle load design curve selected for the design. A line is then drawn



● FIGURE 1. Flexible pavement thickness requirements. In the example worked out above and referred to in the text it is assumed that the CBR value for the subgrade is 4%; maximum single axle load is 18,000 lbs.; and Traffic Classification is very heavy. For these conditions the total thickness of the flexible pavement is 16 ins.

horizontally to an intersection with the vertical axis on the left side of the chart. From this intersection, a straight line is drawn through the point on the "Traffic Classification" scale for the traffic classification selected and is continued to an intersection with the right hand vertical axis labelled "Total Thickness of Flexible Pavement in Inches." This total thickness determination is usually made to the nearest inch.

By arrows on the chart, an example of the use of this chart is illustrated wherein the following assumptions are made for the design of an expressway: Traffic Classification, very heavy; maximum single axle load, 18,000 lbs.; and CBR value for subgrade, 4%. It will be noted that the total thickness of flexible pavement required for these assumed conditions is 16 in. In a similar manner, the total thickness of asphalt pavement for other conditions of subgrade support, maximum axle load and traffic classification may be determined.

It should be noted at this point, however, that the total thickness thus determined may be decreased when certain types of asphaltic bases are used. This modification of the total thickness is discussed later.

Type and Thickness

As a general guide in the selection of the thickness of asphalt pavement surface Table 2 may be used. Table 2 contains suggested pavement thicknesses and references to appropriate Asphalt Institute specifications for these various types of asphalt pavement surfaces.

Suggested thicknesses of asphalt pavement may be varied where local experience provides a suitable basis for such modification. Generally, where high-quality base materials are to be used immediately beneath the asphalt pavement surface, the pavement thicknesses recommended in Table 2 are adequate for even the heaviest loads to be expected on the highway. For extremely heavy axle loads, however, it is common practice to increase these suggested asphalt pavement thicknesses somewhat or to provide a high-quality asphaltic base course immediately beneath the pavement surface. On the other hand, the thickness of asphalt pavement surface for normal axle loadings currently encountered may be reduced moderately when compensated for by an equal thickness of high-quality asphalt base as discussed later.

Type and Thickness of Base

The base course of an asphalt pavement structure is the layer of

Table 2—Asphalt Pavement Surfaces—Suggested Thicknesses and Types

Asphalt Pavement Type	Asphalt Institute Spec.	Pavement Surface Thickness in Inches			
		Light Traffic	Medium Traffic	Heavy Traffic	Very Heavy Traffic
Single Surface Treatment	S-2 or S-3	1-	1-
Double Surface Treatment	S-5 or S-2 + S-3	1	1
Road Mix	RM-1, RM-2 or RM-3	2	3*	3*
Plant Mix	A-6, CL-2, CL-3 or CL-4	2	3	3
Macadam	MP-1, MP-2 or A-1	2†	2½†	2½†
Asphaltic Concrete	‡	2	3	3	4

*Asphalt Institute Specifications RM-1 and RM-2 only are recommended for this traffic condition.

†See Specifications and Construction Methods for Hot-Mix Asphalt Paving, S. S. No. 1

‡Asphalt Institute Specification MP-1 provides for a maximum thickness of 1½ in., and MP-2 provides for a maximum thickness of 2 in. These maximum thicknesses may be used in lieu of those shown, providing the base is "Excellent Base," as classified in Fig. 1.

material immediately beneath the pavement surface. It is usually composed of crushed stone, crushed slag, crushed or uncrushed gravel and sand or combinations of these materials.

In many instances, asphaltic bases may be used to good advantage and such bases are often more economical to build and perform more satisfactorily than non-asphaltic bases. Some locally available materials unsuitable for use as base material by themselves may be up-graded by the addition of an asphaltic binder and serve satisfactorily as a base.

An asphalt penetration treatment of crushed stone, crushed slag or crushed gravel, or an asphalt plant mix of such materials, provides a superior type of base by bonding and waterproofing these aggregate particles with asphalt cement. When liquid asphalts are used in such base construction care should be taken to insure that they are properly cured before placing the asphalt wearing surface. Aggregates for such bases should meet the requirements of ASTM Designation D694, except that gradation may be modified as required for the type of base to be constructed. Where asphalt-treated bases of this type are used, a reduc-

tion in the required thickness of base and also in the required total thickness of flexible pavement may be made. This reduction may be made by considering that 1 in. of such high-quality asphaltic base is equivalent to 1½ in. of non-asphaltic base, provided, however, that the maximum reduction in base thickness and in total thickness shall not exceed 15 percent. Moreover, pavement surface course thicknesses may be reduced by the substitution of asphalt-treated base for pavement on an inch-for-inch basis.

Thickness and quality requirements for asphalt pavement base courses depend primarily upon the volume and axle loading conditions of traffic and, to some extent, upon the quality of the material to be placed beneath. Thickness and quality requirements for these materials are outlined in subparagraphs a) through d) below and in all cases the descriptive terminology used to denote the quality requirements of the material is consistent with that contained in the heading "General Soil Rating as Subgrade, Subbase or Base" at the top of Fig. 1. Where in-place materials meet the requirements for base, as specified in sub-

(Continued on page 162)

Training

HIGHWAY DEPARTMENT PERSONNEL TO USE THE ELECTRONIC COMPUTER

W. A. BUGGE,
Director of Highways
for the Washington State Highway
Commission

NOT TOO long ago, a device that could think like a man, run his machinery and do his figuring was considered a figment of an over-active imagination.

But times have changed and a device capable of doing much of this work is a reality. At a matter of fact, men now look forward to pushing buttons on electronic gadgets to do the world's work. Most of us have accepted them as the answer to many of our production problems.

And while there has not yet been created an electronic device which can actually think like a man, tremendous strides have been taken toward the development of elec-

uses an IBM 650 computer in their computer section.

The new section was given the job of: 1) Developing electronic computer applications under the direction of, and in cooperation with, other divisions of the department; 2) preparing data processing instructions for the engineer and providing proper forms for the submission of data; and 3) processing data in accordance with written instructions and presenting the results in the most effective and logical form.

It was made clear to all personnel that this wasn't another division piled on top of the others in the Highway Department. Rather, it was pointed out emphatically that the primary objective of an electronic computer in highway work was to save engineering man hours. It was stressed repeatedly that results had

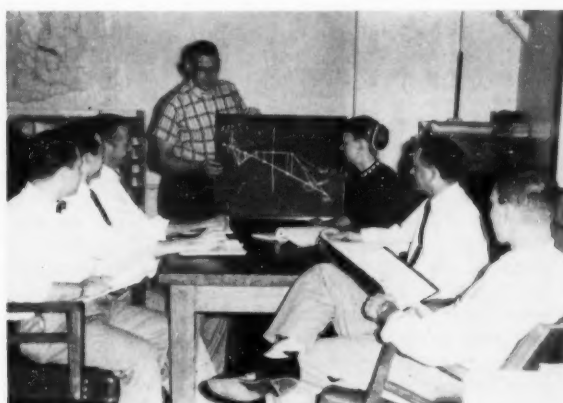
the preliminary planning as well as the final plan preparation is done in the 7 district offices. Education had to start in the local offices of these districts. To indoctrinate personnel in the use of the new electronic equipment it was necessary to talk to the engineers in the field for here was done most of the work that the new electronic machine could be adapted to do.

This would be a big job but it was an important one to accomplish successfully. For before the computer with its flashing panel was to be of any use to the department, men in the field had to be trained to take advantage of the electronic device for their computations and to think of engineering problems in terms of its use.

Much had to be learned. The engineers in the field had to know just what the computer could do for



● **ELECTRONIC** computer is responsibility of special section which develops applications, prepares and processes data.



● **EDUCATIONAL** program was necessary for effective use of computer. Here is a small class studying usage on earthwork.

tronic computers which can do his figuring for him and do it with accuracy much more quickly than can he.

The Washington Highway Department has taken advantage of this fact and has for some time had an electronic section whose duties are to adapt highway problems to the electronic age. The Department

to show unmistakably that this objective was attained.

We are satisfied that the installation has paid off, for periodic reports show that considerably more engineering work is being done at a lesser cost by use of the electronic machines.

Washington has a de-centralized highway department, and most of

them before full usefulness of the new device could be attained.

This was a basic fact we faced:—an educational program had to be carefully charted and efficiently executed.

Earthwork Computation

The plan was to calculate earthwork quantities for the location of

construction projects as the first large-scale application of the electronic computer.

It was recognized that using the computer for this tedious and time consuming activity would free engineers to do other important work. In addition earth-work quantity computation—because of its basic simplicity in adaptation to the computer—would provide a good place to begin using the new electronic instrument.

The educational program, stressing personal contact, had been prepared. It was ready to begin, and in October, 1956, Robert J. Hansen, who heads the Computer Section, gave the department's 7 District Engineers a brief run-down on the mechanics of figuring earthwork quantities with the aid of the computer and explained what the field men must do, how long it would take to process the data, what the limitations would be.

Thus the top man in each of the state's highway districts had the information on the first major application of the electronic computer.

In November, 1956, several copies of a 15-page set of instructions for figuring earthwork quantities using the electronic computer were sent to each resident engineer for use by him and by members of his crew.

A half-day school was held in December at each of the 7 district offices, where engineers learned how to complete the forms which would contain data for the computer.

Then from January through April, 1957, Hansen, together with Ray Cason, a member of the Computer Section, traveled around the state, visiting all offices of the highway department to discuss application of the computer to earthwork quantity computation.

In April, the computer itself was delivered and from April through October, Hansen and Cason visited the residents again. This time they were faced with discussing the subject with residents not on earthwork jobs as on the previous trips, but with problems encountered by engineers who had more complicated four or six-lane highways to build; with engineers who had received results from the data they had sent in for the computer and who felt the need for instruction on how to make the best use of the results.

In December, 1957, another manual of earthwork instructions was published and sent to the engineers. It included a complete explanation of the forms used by the engineer to describe typical roadway sections and ditch and slope standards, and

also explained the tabulated answers of the computed roadway sections and quantities. A half-day school, covering the new manual, was also conducted at each district office during the same month.

In January, February, and March this year Hansen and Cason again took to the road to visit all resident engineers to clarify the additional applications of the computer to earthwork calculations.

New Computer Applications

In May this year programs were developed for computing profile grade and superelevation on projects under construction contract. This program allows the computer section to calculate edge of pavement elevations for superelevation to 1/100 of a foot and to compute blue-top elevations for grading projects. As an introduction to the engineer the required data for this computation were taken from current contract plans and fed to the machine. The results obtained from the electronic computer were sent to the resident engineer on the job.

This program is also helpful on projects under contract where grade changes must be made. The proper corrections may be made on the forms the engineer has received and the forms can then be sent back for refiguring. Soon the engineer receives his elevation changes from the "650".

In October of this year the Computer Section will publish a manual of instructions for traverse computations. Thereafter a four to six-hour school for instruction on the manual will be held in each district, mostly for men under the position of resident engineer.

This has been the manner in which training for the field engineers in the use of the electronic computer has been conducted. A few classes were held, but most of the training, the indoctrination in the use of electronics for highway work, was done by personal contact. The men from the Computer Section have met the engineers on their home ground where the numerous problems encountered come readily to mind. Here in the Resident's office the men from the Computer Section found that they were asked more questions by more men in the informal discussion than they could have been asked in large class-like sessions. And in this manner they could get more information across to the engineers and their crews.

Other training activities relating to the electronic computer have also been carried on for personnel in

other divisions of the Highway Department.

In May, 1956 Val Rinehart, Assistant Engineer of Plans and Contracts, attended a computer school for administrators. Here he learned how it could be adapted to work in his division.

In January 1957, 14 engineers, including personnel from the Materials Laboratory, the Washington Toll Bridge Authority, personnel from the Planning Division, one from each of the department's districts and several people from the Computer Section, attended a scientific school at Olympia on the IBM 650. In this school the personnel learned the intricate workings of the electronic computer, how it operates, how to set up a program for it. After one week of this school one man from the Toll Bridge Authority worked out two applications for the computer on floating bridges which saved nine man-months of time on design work for the Hood Canal floating bridge. This structure, which will have about 1.3 miles of floating roadway, is now under construction in northwestern Washington between the Olympic and Kitsap Peninsulas. Shortly after this school ended, the two men who attended from the Materials Laboratory wrote an application for the computer dealing with materials and have subsequently supervised the writing of another computer application.

Another school on the IBM 650 was held in April, 1957. This time it was a non-scientific school for personnel from various divisions of the department not necessarily directly concerned with construction and design of highways. These included persons from the Traffic Engineering, Personnel and Accounting Divisions, among others. The idea of this school was to introduce the computer to these people and to stimulate them to think of ways in which the computer may help them and their divisions in their work.

Special Application To Bridges

In the Bridge Division, training in the computer is done as the need arises. Eugene D. Lee of the Computer Section handles this phase of the computer activities, working in close personal contact with the individual bridge engineer who needs to use the computer in his particular project. As such a situation arises, a method for computer application is written, not for the particular job, but for that particular type of job. In this manner the

ection has developed methods and used them in the computer for bridge design for moment distribution; beam camber; I-beam section properties; T-beam analysis; moment distribution and influence lines; beam characteristics; moments, slopes and deflections in finite beams on elastic foundations; moments, slopes and deflections in semi-infinite beams on elastic foundations; suspension bridge analysis, bi-axial stress analysis; computation of steel quantities; multi-story moment distribution; truss analysis; indeterminate truss analysis; analysis of laterally loaded piles; and composite beams.

In each six-month period the hours of use on the computer have increased, and it is expected that its use will continue to increase in the future. In the first half of 1957, the machine was used an average of 52.5 hours per month; in the last half of 1957, that figure had increased to an average of 110 hours per month and over the first six months of this year had increased to an average of 152.5 hours per month. It is expected that during the last half it will have been used an average of 190 hours per month, an average of 220 hours per month in the first half of 1959 and an average of 240 hours per month in the last half.

The conclusion we reach is this:—our training program is working; the engineers are using the computer and are getting the work done with its aid—and at a lesser cost than formerly.

During the past year 1,900 miles of earthwork quantities were processed in the Computer Section. This amounted to about 400 actual miles of roads in the reconnaissance and location stages and 75 miles in the construction stage. On the average during the first six months of this year, 215 miles of earthwork were computed each month. For the average design project at least three sets of earthwork quantities have been computed. As the field engineers become more familiar with the computing process it is estimated that at least six sets of quantities will be computed per project to enable the engineer to arrive at the most efficient design.

It has also been estimated that during the first six months of 1958 man-hour-design savings resulting from the earthwork computations alone amounted to a minimum of \$60,000.

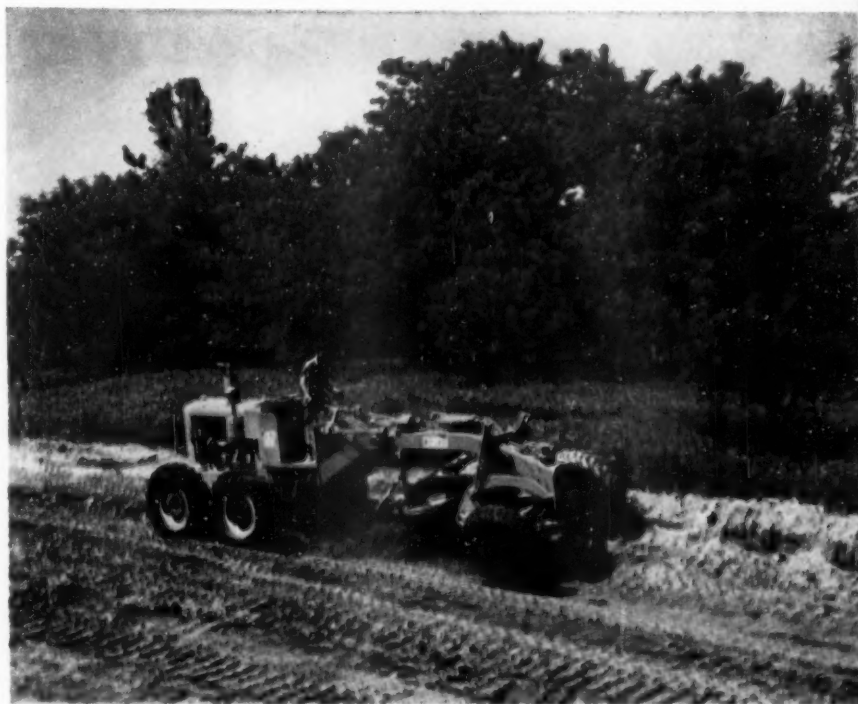
In the meantime, training continues. Each month the computer section publishes a report to the super-

visors to provide information on what the section is doing and what new ways it may help them in getting their phase of the highway work done. Another medium of information is the Washington State Highway Commission's bi-monthly magazine, *Highway News*. This magazine, distributed to all employees, carries stories on the computer and its applications within the department.

We expect that the usefulness of the electronic machine and its

adaptability to highway work are almost unlimited. Each day another use is found short-cutting traditional methods.

The highway department's job as a state agency charged with constructing and maintaining highway facilities for a growing population requires that it use every resource at its command to ensure the best motor transportation possible. The electronic computer, with personnel properly trained to its use, will make it possible to do just that.



● FARM-TO-MARKET road construction in Tennessee utilizes Galion 160 motor grader. Cuts to 20 ft. deep required movement of 141,000 c.y. of dirt on 6-mile job.

FARM-TO-MARKET ROAD CONSTRUCTION

REWORRING and building a secondary or farm-to-market road near Clemp, Tenn., required equipment of various types. The road has a 60-ft. right-of-way and a 27-ft. roadway.

Machines used on the job included one TD24 International push tractor, one TD18 International tractor clearing right-of-way, two 2T55 International scrapers, one Galion 160 motor grader and one Model R John Deere tractor pull-

ing a sheepsfoot roller. The motor grader was used to maintain the haul road, work the roadway and shape the slopes.

This six miles of road required 62 hill cuts and bank slopes with some of the cuts being up to 20 ft. in depth. There were 141,000 cu. yds. of dirt moved on the job with the type of soil being sandy clay.

The job was contract let and was done by the state with Federal funds.

SALT STABILIZATION:

PAUL J. KAISER, PE,
Engineer-Manager,
Van Buren County Road Commission,
Paw Paw, Michigan

IT WASN'T long ago when our only contact with sodium chloride was salting our meat and pota-

tatoes from your salt supplier detailing the simple steps of salt stabilization.

Van Buren County, principally an agricultural area, is served by a network of 700 miles of gravel roads and 550 miles of bituminous surfaced roads under the jurisdiction

ing $\frac{3}{8}$ -in. sieve, 65-85 percent; passing #10 sieve, 30-45 percent; passing #200 sieve, 3-8 percent; and clay 5 to 8 percent.

When the required amount and gradation of aggregate has been obtained, we are ready to begin the actual stabilization. Fine salt is de-



● **SALT APPLICATION:** The road is previously wetted, windrowed and again wetted to prepare it for the application of salt.

toes at the dinner table. Today, however, chlorides have become some of the important tools of the highway industry. Four years ago we in Van Buren County placed our first salt stabilized road. Little did we realize that this experimental strip would develop into a program embracing over 110 miles of local gravel roads plus bases for bituminous surfaces.

Standards of Practice

When we began our stabilization program there were no published handbooks, little was known about the actual process, the amount of material to use, the most satisfactory aggregate gradation and the chemical processes involved in salt stabilization. Since then the interest generated in salt stabilization has led to research and to the development of standards of practice by engineers, educators, and the major sodium chloride producers. Illustrated bulletins can now be ob-

of the county road commission. Basically our construction procedures have not changed since our first stabilization project. We have, however, analyzed the results of our various jobs in an effort to determine the aggregate gradation, organic content, and the amount of sodium chloride necessary to produce the best all around results.

When the selection of the routes to be stabilized has been determined, the commission's engineering staff studies the condition of the existing road structure. Drainage structures and ditches are checked and betterments are made by maintenance forces when necessary. The amount of aggregate present and its gradation is determined, and from the results of these tests, additional aggregate, fines and/or organic material are added as needed. We strive to maintain a uniform aggregate gradation as follows: Passing 1-in. sieve, 100 percent; passing $\frac{3}{4}$ -in. sieve, 90-100 percent; pass-

livered by truck transport, in bulk, to the job site. A Seaman-pulv-mixer, Michigan front end loader, wobble wheel roller, material spreader, two motor graders, two water tank trucks and a water pump are moved to the project.

Construction Process

There are three principal steps in sodium chloride stabilization as practiced in Van Buren County. They are first, wetting; second, mixing; and third rolling.

If possible, the entire roadway is watered for several days before construction. Then two motor graders, working in tandem, windrow the aggregate to the centerline thus enabling us to determine that we have a uniform distribution of material. The windrow is then struck off a uniform width of approximately 12 feet with a motor grader moldboard. The material is again wetted and is now ready for the salt application.

AN IMPORTANT ROAD BUILDING TOOL



● After the salt is applied, two motor graders blade-mix and windrow. These are followed by the Pulvi-Mixer, which makes several passes, preceded by wetting.

The salt, delivered in bulk, is loaded into conventional dump trucks with the front end loader. We now use a uniform application of one pound of chemical per square yard for each inch of compacted thickness. The salt is shot on the wetted, struck off windrow with a Good Roads material spreader.

The mixing process begins with the two motor graders, following the water wagons, blade-mixing the salt and gravel into a centerline windrow. Mixing with the Pulvi-Mixer then begins. Several passes, each preceded by wetting are made; insuring mixing, proper aggregate distribution and complete solution of sodium chloride. Upon completion of the mixing cycle, the motor graders again windrow the material to the centerline. This windrow then is split to each shoulder.

The sub-base is thoroughly saturated with water, the motor graders then lay half of the aggregate from the shoulder windrows to line and grade; wetting continues and rolling begins. The first lift is compacted to optimum density with a wobble wheel roller towed by the front-end loader. When density is obtained, the remaining material in windrow is placed to line and grade. Wetting and rolling continues until the surface is hard and true. The final step is the application of 1,000 gallons per mile of 36 percent liquid calcium chloride.

Our experience over the past few years has indicated several features of salt stabilized roads. When used as a wearing surface, the life of one

treatment appears to be approximately three years. The surface should be treated with calcium chloride to soften the surface thus reducing "pot-holing."

When used as either a base or surface stabilizing agent sodium chloride tends to reduce the freezing point. An insulating layer is thus created and frost does not penetrate to normal depths. This reduces frost action and spring breakup is at a minimum or eliminated.

Sodium chloride used as a stabilizing agent in base courses under bituminous surfaces, enables us to design for a heavier axle loading with less base course thickness than with conventional aggregate bases. The lowering of the freezing point is also a very important factor in prolonging the useful life of flexible pavements.

As we continue to use salt in our road building processes, I am sure we will develop additional uses which will continue to make sodium chloride one of our important road building tools.



● ONE OF the steps in blade-mixing with motor graders; wetting is continued during the turnover process. Rolling continues until the surface of the road is hard and true.

SIGNS

FOR INTERSTATE HIGHWAYS

ROBERT A. BURCH,
Traffic Engineer,
North Carolina State Highway
Commission

THE EFFECTIVENESS and usefulness of any sign depends upon its legibility and its legibility is in direct proportion to the size of letter used in spelling out the message. As the size of letter increases the size of the total sign increases.

The purpose of any sign is to give the driver the needed information legibly at the time it is needed and in a manner to suit all prevailing conditions. As road facilities are built to accommodate and permit higher speeds the demand on signs will be even greater. Regardless of the values used in establishing what amount of time is required for a driver to see, read and transfer a message to his mind and then react to it—and this time value may vary greatly—all will agree that at high speeds a greater distance is required to get the message to the driver and allow him to react to it. The service provided by a sign is in direct proportion to the amount

of time during which the sign is legible to the driver. A driver approaching a sign at a speed of 30 mph will have twice the legibility he would have than if he were approaching the sign at 60 mph.

As the size of letter used in making a sign increases, the overall size of the sign naturally increases and as a result the cost of the sign increases in proportion. As the original cost of the sign increases, more concern should be given to the cost of maintenance. There is a need for consideration to obtaining longer life and more usefulness from the original expenditure since frequent replacement or maintenance of expensive signs can become a significant economic factor. Therefore, if the original sign can be made to last 10 or 15 years, rather than the normal 4 or 5 years of the past, an additional increase in the cost of the original installation other than that which would be required by the increase in size alone is justifiable.

Engineers for some time have had the know-how and ability to build facilities of a type similar to what the Interstate System will be. They have not done so because of the

lack of economic feasibility and the demand on them to spread available funds over a greater mileage than would have been possible by building to these high standards. Likewise Traffic Engineers have had the know-how and have been able to provide the operating services afforded by the better signing which will be seen on the Interstate System. Here again the difference was a matter of cost. Signing until recently has not been considered an essential need or of very high priority.

The Highway official charged with the responsibility of signing the Interstate System has a very important decision to make in just what type of materials should be used in fabricating the signs as well as the method of erecting them.

Adoption of Uniform Manual

Many of his problems have been solved by the adoption of a uniform manual for signing the Interstate System. This Manual sets forth certain requirements and regulations which are mandatory and which relieve him of the possibility of criticism for going beyond what would



● ALUMINUM box truss has span of 90 ft., supports 375 sq. ft. of sign area. Traffic and Street Sign Co. was awarded the contract to supply the signs and aluminum supports. Pfaff and Kendall manufactured the aluminum spans and supports.

be necessary in the minds of certain people. The requirements of the Manual do not, however, make decisions for him as to what types of materials should be used to insure the longest life and the least maintenance in future years.

North Carolina has elected to do the best job possible in erecting signs on the Interstate System. It is the intent to comply with the requirements of the Manual 100 percent; it is also the desire to erect the signs in a manner which will give the longest life; and to have them fabricated from materials which will require the least maintenance thereby reducing all costs to the absolute minimum.

The Manual specifies certain requirements which will cause us to

various states, but it stated that this should be done in a uniform manner so as to prevent each separate state from having a different system of signing which would result in a confused traveling public. The Act made it essential that a uniform system of signing be adopted by all of the states which must be approved by the Bureau of Public Roads. Such has been done. The published manual implements this provision.

The cost of adequate and up-to-date signing is but a fraction of the total cost of a facility. The difference in cost between mediocre fulfillment of the bare necessity in signing, as has been practiced in the past, is negligible in comparison with excellent or first class signing. The

fic with all signs placed in accordance with the Manual. Table 1 gives some data on the two projects:

From Table 1 it is readily seen that no uniform cost of signing can be applied to the Interstate System or that a uniform or average cost per mile can be determined.

One of the influencing factors in fixing the cost of signs is the number of over-the-road bridge structures required for mounting signs over the travel lane. The Manual has set up very definite warrants for the use of such sign bridges; but the design features incorporated in construction likely will be one of the determining factors in deciding whether or not a bridge will be used. For example, if the diamond-type ramp is built there is only one exit for each direction of movement and the over-lane signing is not as important. With a design similar to the full clover-leaf treatment where there are two exits, the sign bridge is needed to provide proper over-the-lane message. The majority of the structures used on the two above mentioned projects had clear spans of 90 feet and two had spans of 94 feet. The shortest one was 80 feet. The cost of these structures is not known because the bid price for them was included with other signs, but it is estimated that each of these structures cost in excess of \$7,000.

Structures Are of Aluminum

The structures are of aluminum of the square box truss type. Substantial footings were required for these wide spans. It was intended to construct spread footings of concrete 4 ft. by 14 ft. and 2 ft. thick with a 2-ft. wide stem rising to a point 2 ft. above the ground and with a total depth of footing of 6 ft. Due to the fact that some of these footings were located on fill sections and because of superelevations and other reasons some of the footings turned out to be 11 ft. deep. A minimum of 15 cu. yds. of concrete per structure was used with some requiring 25 cu. yds. Pouring of the concrete footings constituted the major work in erecting the sign bridge. The uprights were in one piece and due to their light weight no problems were encountered in erecting them on the footings. The truss across the road was delivered in three pieces and was bolted together on the ground with stainless steel bolts, then lifted into place with a crane. The total time needed for the erection of one of the structures was less than two hours and the time required for lifting the



● URBAN area sign 18 ft. long by 5½ ft. high is located at the beginning of the deceleration lane. Exit sign in the bullnose measures 6 ft. long and 5 ft. high.

place signs with a degree of service far in excess of our present policies, and in some instances beyond the willingness in the minds of many to accept as necessary. However, this will be accomplished and is made possible by the fact that the 1956 Federal Aid Act provided money for the building of the Interstate System. At the same time the Federal Government set up many requirements as to how the system should be built and operated. It is fortunate that this Act did include foresight and sufficiently good thinking to require that the signs, which are the most important thing controlling the operation and effectiveness of the System, be erected in an acceptable manner. The Act delegated the responsibility for signing this System of routes to the

Manual for signing the Interstate System provides for first class signing.

During the summer of 1958 two sections of the Interstate System in North Carolina were opened to traf-

Table 1—Data on Highways

	I-85 Near Charlotte	I-40 Near Greensboro
Length of Job	11 mi.	17 mi.
Intersections	9	10
Project Cost	\$4,700,000*	\$3,800,000*
Sign Bridges	4	5
Sq. Ft. of Signs	9,000*	12,000*
Cost of Signs	\$91,000*	\$127,000*
% Sign Cost	1.9	3.3
Erection Cost	\$15,000*	\$15,000*

*Approximate

truss in place, which is the only operation interfering with traffic, required less than 10 minutes.

Due to the newness of the type of sign and because our forces had never before placed footings of this type, some delay due to lack of experience was encountered in the beginning. No special crews were employed. Regular sign erection crews and centerline striping personnel were used for the entire job. Setting of tapered aluminum poles on anchor bolts protruding from a concrete footing was a new thing to our forces and required some experimenting and organizing before efficient production was accomplished. After setting a few poles three separate crews were organized. One crew of three men with a power auger moved in front digging holes. A second crew of two men followed and placed a wood box form over the top of the hole, suspended anchor bolts from the top of form and made the hole ready to receive concrete. A third crew of three men filled the holes and forms with concrete discharged from a ready-mix-truck.

After the concrete had set, tapered aluminum poles were placed on the bolts and the sign frame, which was in the form of aluminum Z bars with tubular struts, was fastened to the poles. The sign panels were then hung onto these Z bars, slid into place and fastened with J bolts at each end and with set screws at intervals along the Z bar. Signs 8 to 10 ft. high with widths up to 20 ft. can be erected with a crew of 4 or 5 men at the rate of one per hour. The major work involved with erecting these signs was that of properly setting the concrete footings, arranging the anchor bolts, and

transporting the materials to the exact spot when and where needed. Due to the fact that the purchased signs fitted together very easily they constituted no problem when being hung on the poles.

Special types of equipment not normally used in sign erection were necessary. It was found that a light crane greatly expedited the work by hoisting the sign in place, especially in those cases where the complete sign was bolted together before being hung on the poles.

Features of the Manual

Reference has been made to the "Manual" in the above discussion and it is felt that it is appropriate to point out some of the features of the Manual. The philosophies embodied in the Interstate Manual are slightly different from those of the Uniform Manual. The design of signs for the Interstate System was approached with the premise that the sign is primarily for the benefit of unfamiliar drivers and was conceived to give information which would permit rapid, convenient and safe travel. This new concept specifies that a driver be given information well in advance of the point that he is to make a decision and all information pertaining to an exit should be displayed two miles in advance of the exit, repeated one mile in advance and then given the third time at the beginning of the deceleration lane which is provided immediately in advance of the exit. At the point of bifurcation, then, his decisions have been made and there is supplied only the simple word, "Exit", with an arrow pointing in proper direction of his desired movement. Due to the fact that there are no cross conflicts, warning

signs are not used by the Interstate Manual except to a limited degree such as telling the driver that traffic is merging ahead.

The color scheme of the signs specified by the Manual has, for the first time, an assignment of the green color for a specific purpose. The green color is used for all distance and directional signs. The new Interstate route marker employs the use of three colors, red, white and blue, which makes it distinctive from any other route marker or highway sign. A new combination of colors using a green message on a white background has been specified for certain uses such as "Rest Areas" and "Services".

Possibly the greatest change from past signing practices required by the Manual is that pertaining to sign lettering, spacing and size. Use of the lower case alphabet is required for all place names. This lower case alphabet is used in conjunction with a capital initial letter 1 1/3 times the height of the lower case letter. The Specifications for the overhead signing required at certain places also involve a big change from past signing.

When the new Manual was first released there was some criticism of its requirements, mainly regarding the square footage specified for these signs. It is felt that all criticism will vanish from everyone's mind after they have had an opportunity to view the signs in place. The general appearance of the signs is excellent and they are legible both night and day for an adequate distance. The general esthetics of the signs and the superior materials used add to the beauty of the road and contribute to the comfort and safety of driving.



● THIS SIGN is one mile in advance of the exit to downtown Charlotte. Sign measures 12 feet square and is designed to withstand wind load of 40 lbs./sq. ft.



● ADVANCE exit sign is 24 ft. long by 9 ft. high. Basic construction of the large signs is Tassco sheet increment design with reflectorized Scotchlite background and AGA letters, numerals and border.

USE OF PRESSURE PIPE IN PUBLIC WATER and SEWER UTILITIES

WALTER L. PICTON

Director,
Water and Sewerage Industry and
Utilities Division, Business and Defense
Services Administration,
U. S. Department of Commerce

MORE THAN three billion feet of pressure pipe will be installed and in use by 1975 in the public water and sewerage utilities of the continental United States, it is estimated in a recent study by the Water and Sewerage Industry and Utilities Division of BDSA. These will serve as transmission lines and distribution mains to provide water and sewerage for industrial, commercial and domestic uses.

In June, 1957, the Division released the results of its study of the national annual requirements for pressure pipe for water mains and related uses. The present study has now developed estimates of the millions of feet of pressure pipe presently installed and in use in the Nation's public water and sewerage utilities.

This study presents a general picture of the estimated past and present footage of pipe in use, with a projection in future years covering only the public water and sewerage utilities. It does not include the footages in use by industries, gas utilities, Federal Government installations and other miscellaneous users. The presentation includes the estimated total use of pipe for the purposes covered, with breakdowns by type and size of pipe.

The study is based upon statistics and estimates assembled from a number of sources. It is designed primarily as an aid to producers of pressure pipe in planning production programs. The data will also be of interest to officials of public water utilities for comparison with details on their own and other systems.

The four principal types of pressure pipe in use are cast iron, asbestos cement, reinforced concrete and steel. The pipe sizes have been

divided into three classes; 2-in. to 12-in.; 14-in. to 24-in.; and over 24-in.

The projections of estimated requirements to 1975 as presented are not to be considered as a firm forecast, but are designed primarily to illustrate the footages of pipe that will be required by a projection of present trends. Although individual years may vary from the general trend because of other factors, the general picture presented is believed to be representative as a national summation.

Basis of Estimates: The previous study developed estimates of the annual requirements for pressure pipe for new construction and maintenance and replacement. The same estimates were used to develop the

increase in the footage in use after due allowance for depreciation and obsolescence.

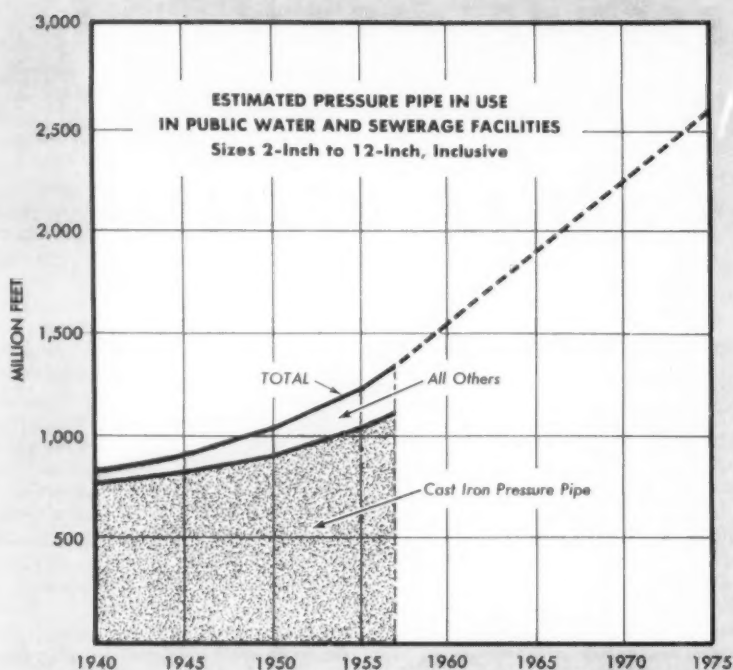
Comparisons of footages of pipe were made on a per capita basis with the results of the American Water Works Association surveys of 1945, 1950 and 1955. Similar comparisons were made with data in annual reports of a number of water utilities and the National Board of Fire Underwriters reports. From these reports, it was possible to develop an estimated average size pattern within each of the major size classes.

Projections to 1975: Extensions of service to new homes and also to old homes represent a major percentage of the need for increase in pressure pipe in water and sewerage utilities.

TABLE 1—Estimated Pressure Pipe In Use In Public Water And Sewerage Facilities

Lengths in Millions of Feet

Year	Cast Iron Pressure Pipe	Steel	Asbestos Cement	Reinforced Concrete	TOTAL All Types
Sizes 2-inch to 12-inch, Inclusive					
1940	760	13	76	1	850
1945	811	14	82	1	908
1950	907	19	106	2	1,034
1955	1,037	27	160	3	1,227
1956	1,074	30	178	4	1,286
1957	1,114	33	198	4	1,349
Sizes 14-inch to 24-inch, Inclusive					
1940	61	8	3	3	75
1945	68	10	3	4	85
1950	81	14	5	7	107
1955	98	22	10	16	146
1956	102	24	11	19	156
1957	107	27	12	22	168
Sizes Over 24-inch					
1940	10.4	10.5	0.2	2.8	23.9
1945	10.9	11.2	0.2	3.1	25.4
1950	11.8	13.0	0.3	4.5	29.6
1955	12.5	15.3	0.3	6.4	34.5
1956	12.6	15.8	0.3	6.9	35.6
1957	12.8	16.3	0.4	7.3	36.8



● FIGURE 1. Estimate of 2-in. to 12-in. pressure pipe in use, with extension to 1975. Total does not include pipe in privately owned or Federal government systems.

TABLE 2—Estimated Pressure Pipe In Use By Public Water and Sewerage Utilities

		All Types of Pipe Lengths in Millions of Feet			
Year		2-in. to 12-in.	14-in. to 24-in.	Over 24-in.	Total
1940	Length	850.2	74.7	23.9	948.8
	Percent	(89.6)	(7.9)	(2.5)	(100.0)
1945	Length	908.6	84.7	25.4	1,018.7
	Percent	(89.2)	(8.3)	(2.5)	(100.0)
1950	Length	1,033.8	107.4	29.6	1,170.8
	Percent	(88.3)	(9.2)	(2.5)	(100.0)
1955	Length	1,227.8	145.5	34.5	1,407.8
	Percent	(87.2)	(10.3)	(2.5)	(100.0)
1957	Length	1,349.0	168.0	36.8	1,553.8
	Percent	(86.8)	(10.8)	(2.4)	(100.0)

TABLE 3—Estimated Pattern Of Sizes of Water Mains Presently Installed and In Use In U. S. Water Utilities

2-in. to 12-in.		14-in. to 24-in.		Over 24-in.			
Size	Percent	Size	Percent	Size	Percent	Size	Percent
2	4.7	14	6.3	30	38.2	50	0.6
3	1.2	15	0.2	32	0.1	54	1.3
4	8.6	16	47.3	36	30.9	56	0.2
6	52.2	18	2.7	38	0.1	60	3.3
8	19.1	20	23.6	40	0.8	62	0.4
10	4.9	24	19.9	42	4.9	66	0.3
12	9.3			48	18.4	72	0.5

Accordingly, the population projection is the primary foundation of the future pattern of increase in installed footage. It is assumed that an increasingly larger percentage of the national population increase will locate in metropolitan areas, with a gradually but slightly decreasing number of persons per household for the estimated increase in number of customers, with due allowance for residential retirements and conversions. It is estimated that the footage per domestic customer is increasing as the percentage of suburban fringe population increases and can be expected to continue to increase in the next two decades.

Figures and Tables: Figure 1 and Tables 1 and 2 present in graphical and tabular form estimates by millions of feet of pressure pipe installed and in use at intervals from 1940 to 1957 inclusive. These estimates do not include pipe in privately owned and operated water and sewerage systems of industries, gas distribution systems, Federal Government installations and other miscellaneous systems for water and sewerage. Those uses can be included by adding 15 percent for the industrial, Federal and miscellaneous and adding 36 percent for gas distribution, according to our rough estimates.

Table 2 presents a summary of the total millions of feet of pipe in use at intervals from 1940 to 1957 broken down into size classes, indicating the percentage of the total represented by each class. The estimates indicate a gradual decrease in the percentage represented by 2 in. to 12 in.; a gradual increase in the percentage represented by 14 in. to 24 in.; but slight if any change in the percentage represented by over 24 in. pressure pipe.

Table 3 presents a breakdown of each size class into actual sizes as a percentage within each class. This is the estimated pattern of sizes as of 1957. Although the size pattern is changing, the rate of change is estimated to be gradual as indicated by Table 2.

The projections to 1975 are considered to be on the conservative side because the population projection used as the basis for estimating is approximately equivalent to the low projection of the Bureau of the Census. If the high projection had been used, the projected footage for 1975 would have been more than 10 percent greater. However, it is believed that the general picture presented is representative with respect to the national summation of future pressure pipe requirements for water and sewerage utilities.

IMPORTANCE of SOILS SURVEYS and FOUNDATION STABILIZATION in **SUBDRAINAGE**

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MODERN traffic demands, due to the phenomenal increase in both cars and trucks, has made it necessary that increasingly high standards in the design and construction of present and future highways be maintained and expanded to meet the present and expected future usage.

Many highways constructed in recent years and considered adequate have experienced major failures because of inadequate foundation support. In some cases expedients of first-cost economy had sacrificed or minimized sub-surface explorations and hydraulics study.

Inadequate ground water control is recognized by engineers as one of the major causes of pavement failures. In many cases subsurface water results in soil volume change, resulting in loss of bearing capacity and subsequent surface distortion. This is borne out by numerous investigations of failures in both flexible and rigid type pavements. Progressive failure of flexible type pavements due to subgrade change usually results in pot-holing, raveling, rutting and lateral movement. Rigid pavement failures under the same conditions result in warping at the joints, slab movement and pumping, resulting in loss of subgrade bearing and the subsequent cracking or complete failure of the slab unless remedial action is taken.

The above failures are not to be confused with pavements of inadequate thickness to support the loads superimposed on the surface.

Information contained in historical data together with experience of highway and railroad engineers have led to the conclusion that proper design criteria cannot be obtained without adequate information as to soil classification and to surface ground water conditions.

The purposes of subdrainage are to intercept and remove seepage and to lower the water table under areas that require stable subgrades. Whether to construct an extensive system of subdrains or to raise the grade and reduce the number of subdrains is a matter for investigation and recommendation by soil or drainage engineers.

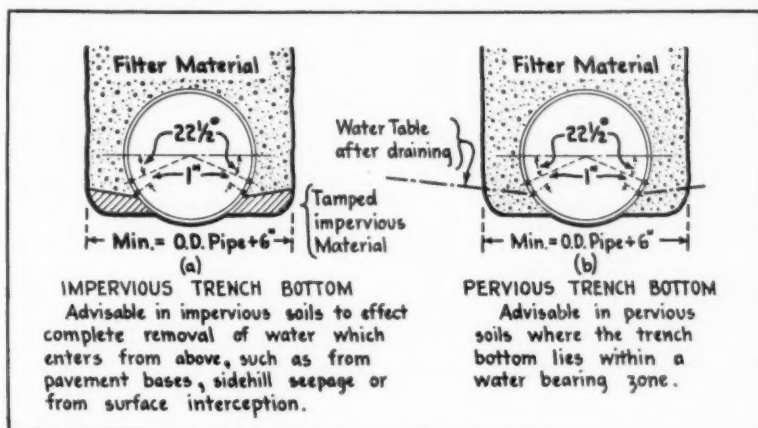
The purposes of the soil survey are of course important for the following reasons:

1) To determine the nature of the soils, the soil profile and the

tures small pockets of sand and silt sometimes act as water wells which may cause considerable damage to a soil foundation or base course, due either to softening of the soil or to frost action during the winter season.

d) Impervious ledges. All impervious shale and rock ledges should be regarded as planes along which seepage may occur.

e) Permanent water tables occur in flood plains of many streams, both large and small. In many locations the elevation of the water



● SUBDRAIN trench construction for conditions in pervious and impervious soils.

existing density and moisture conditions. These determinations serve as a basis for design of subdrains, subgrade, base course and surface of the facility. Erosion of the slopes and drainage channels is a function of soil topography.

2) Second in importance and value to field identification of the soils is the accurate and complete location of areas that carry underground water.

Some of the general conditions associated with underground water are:

a) Loams on impervious clays;
b) highly structural or joint clays;
and c) sand and silt pockets on impervious clay. In glacial struc-

table varies with the seasons or with the annual rainfall cycles. Wherever a water table exists, exact notes should be obtained on the elevations of the water and the moisture contents of the overlying soil.

f) Detecting seepage. Many soil layers carrying seepage have been missed because the engineer expected to find free flowing water when making the borings. Wherever impervious planes are evident, test holes should be left open at least 24 hours and inspections made to detect indications of free water.

Failures in surfacing on adjacent highways or the presence of vegetation are excellent aids in detecting



● UNLOADING 20-ft. lengths of perforated corrugated metal pipe is easy because of the light weight. Note the special fitting provided for joining three branches.

the presence of subsurface water. Reeds, sedges, cottonwoods and willows thrive in many places where seepage occurs even though the seepage may be seasonal.

Competent engineers who study drainage problems know that water on definite seepage planes can be intercepted by placing drains and that the water tables can be lowered. There exists, however, numerous places where excessive moisture content or free water exists that cannot be effectively drained with pipe drains. Under such conditions a blanket of granular material may be necessary to prevent the water from rising to the surface.

At other places, drainage may be feasible with pipe drains, but is uneconomical, because of the depth and type of excavation, and the length of pipe and trenching required to dispose of the water. At such places, blankets of granular material may be more economical than drains.

Normally, selection of the most economical drain will be made by the design engineer. The engineer conducting the soil survey should obtain such test data as will enable the designer to select the most feasible type of drainage.

The report should include a discussion of the soil types shown on the soil profile and recommended treatment of each type to produce a satisfactory foundation for the base course and surfacing. Discussion of soil types should be in sufficient detail to be of value in the design, construction and maintenance of the facility.

The soil classification and moisture-density relations should be an important section of the report. The following five soil conditions are commonly indicated for consideration:

1) Pervious soils that require little or no drainage. In their natural state these soils permit water to pass through them fairly quickly and facilitate subdrainage. They are excellent for sub-bases when taken from borrow-pits and placed on impervious soils.

2) Impervious soils that cannot readily be drained. Such soils do not readily permit water to pass through them. Where the land is flat, rainfall lies on the surface until the soil absorbs part of it and the rest evaporates. A well drained layer of pervious material over such soils is usually effective in maintaining sub-grade stability.

3) Soils pervious above and impervious below. This condition permits water to pass through a thin pervious layer and collect on the impervious material below, thus forming a layer of unstable saturated soil. This water may be removed by subdrain pipes laid on or partly within the impervious layer.

4) Soils impervious above and pervious below. To permit the escape of water collecting on a relatively thin impervious layer, trenches may be dug through to the pervious layer below. Subdrains are laid in this pervious layer and, in addition to removing surface water, may serve to lower the water table.

5) Irregular strata of pervious and impervious soil. Such formation may

contain water pockets or springs that will require separate drains leading to the storm drain system or other outlet.

Tests should be made to determine if the water table is close enough to the surface to imperil the stability of the surface or contribute to frost heaves. The ground water table is not necessarily level nor does its elevation remain constant. A few inches of rainfall may raise it several feet.

Note: In certain soils, such as silts or silty sands, frost heaving is caused by capillary moisture that cannot be removed by drainage. The most effective methods of preventing frost heave are removal of the unfavorable soil and replacement with a suitable material that is not subject to frost heave.

Purpose of Subdrains

Intercepting drains are used to collect and dispose of surface water and subsurface water flowing to the facility from adjacent areas.

When necessary and feasible a system of subdrains within the facility is used to lower ground water level and reduce frost heave.

Storm drains serve primarily to remove surface water but are also used as outlets for sub-surface water when a sub-surface system is required. It is seldom necessary to design storm drains and outlets for the combined flow of both ground and surface water because the peak load of surface water usually passes before the ground water reaches the drains. In regions where the rainfall is heavy, it may be necessary to install intercepting drains parallel to and outside the roadway and at such intervals that the water will be collected before its volume becomes great enough to produce erosion. Also intercepting drains may be installed on the upper side of the roadway areas to prevent water from flowing across them. A great many engineers today are of the opinion that, in the interest of safe operation, no open ditches be permitted within the limits of the highway facility. Pipe conduits covered with earth are recommended.

Subdrainage Pipe

The principal types of subdrainage pipe available are as follows:

a) Corrugated Metal Pipe: Perforated riveted pipe; plain, circumferentially riveted pipe; two-piece riveted pipe; and helically corrugated pipe.

b) Vitrified Clay Pipe: Plain, bell and spigot type laid with open

joints; partially perforated clay pipe laid with either open or closed joints; and completely perforated clay pipe laid with either open or closed joints.

c) Concrete Pipe: Perforated; and open joint and porous.

Subdrainage pipe most frequently is installed in earth which is either saturated with ground water at the time of installation, or which may, under severe weather conditions, become temporarily saturated for a short period. At such times, as a result of the earth being in a semi-plastic state, it will have a tendency to shift or move internally under the wheel loads of traffic, or oftentimes under its own weight. Such movement tends to disrupt the joints of the pipes in subdrains. When one single joint of pipe is disrupted or disjointed, the entire subdrainage system above the break in continuity will be rendered useless since the outlet for infiltrating ground water from the disrupted joint is obstructed. Also that portion of the subdrain below the disrupted joint will lose its efficiency because of soil sifting into the pipe at the break. Therefore, care should be employed in designing and constructing subdrains to insure that they will function properly and will not shift position.

Corrugated metal pipe is available in long lengths, a single length often being sufficient to form a complete lateral. The joints of the pipe are fastened with corrugated connecting bands which secure each length of pipe to the adjoining length in such a manner as to afford a positive joint. The closed joints, tightly connected, prevent disjointing, loss of alinement and clogging under the pressure of shifting soils, unstable foundations and frost action. Due to continuous beam strength, no cradling or other special supports are required.

The perforations in corrugated metal pipe are designed to admit water freely and at the same time exclude backfill material. Engineers have conducted exhaustive tests to determine the most practical design of these perforations when used with recommended backfill materials. The purpose of these experiments was to determine the proper size, number and spacing of perforations to admit the required amount of water and exclude detrimental quantities of solids. These tests resulted in perforations that permit the water to enter along the entire length of the drain. In this way there is little longitudinal flow outside the pipe in the backfill ma-

terial and the perforations are not likely to admit solids that would clog the line.

Installation Practice

Assuming the subdrains are designed as to best location, the proper depth, the proper trench bottom, etc., installation of a subdrainage system is comparatively simple when using corrugated metal pipe. For general subdrainage work the pipe should be placed with perforations down. This helps prevent infiltration of silt, gravel or other solids that might clog the line and destroy the effectiveness of the system. With the perforations down, solids have to move upward against gravity to get into the pipe. Placing the perforations down also assures a lower water table. A cap should also be installed at the upper end of the pipe to prevent entrance of solids.

Where portions of the line are used as water conductor rather than an interceptor, it is permissible to place the perforations up. However, in these cases, it is preferable to use non-perforated pipe. With either type of pipe, a pervious backfill is not necessary for this portion of the line.

Filter Material

Past experience has proved that coarse backfill is definitely not a material to be used in subdrain trenches. Numerous drains when uncovered have revealed a completely clogged condition.

An investigation in this field was carried out in 1941 by the U. S. Corps of Engineers at the Vicksburg

Water Experiment Station. After receiving the assignment to build airports for the Army, the Corps set up tests to determine filter requirements of underdrains.

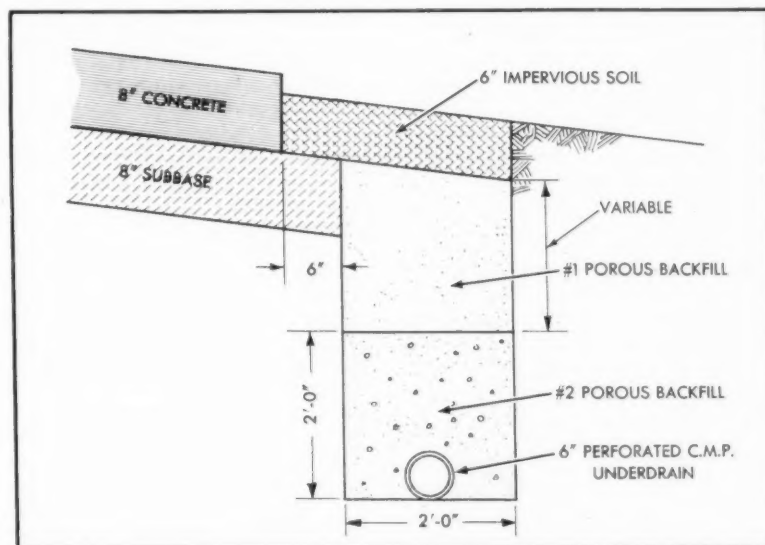
In essence they found that the 15 percent size of the filter material must not exceed 5 times the 85 percent size of the adjacent soil material if this adjacent material is to be prevented from passing through the filter and clogging the drain. The 15 percent size of the filter material, however, need not be less than 0.1 millimeter if the soil is cohesive.

Generally speaking, the AASHTO specifications for concrete sand meet filter requirements. Unusual conditions may, however, require special filter treatment.

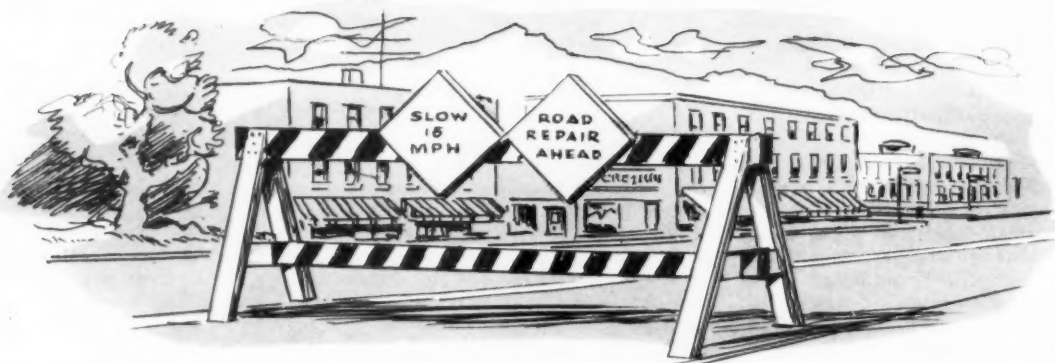
Recent developments and continuing studies of proper backfill material are the outstanding forward step in subdrain construction in many years. It insures continued service of the drain, providing infiltration area in the pipe is properly designed.

While a knowledge of hydraulics and soil mechanics are to a certain degree essential in the location of subdrains, good judgment is of first importance. The most difficult problem is the determination of under surface conditions, especially the location of free ground water. Many states employ a geologist to assist the soils department in such problems.

Some one once said, "A good road requires a tight roof and a dry cellar." It follows that good subdrainage is the best and cheapest insurance for highway foundations.



● DETAIL showing recommended practice for an underdrain adjacent to pavement.



CONTROL and PROTECTION of TRAFFIC DURING HIGHWAY CONSTRUCTION

During road and highway construction, provision for adequate detours, barricades, directional and warning signs at or near a job site represents fulfillment of a public responsibility by contractors and Public Works departments as defined by law. Design details of signs and devices and degree of need for these controls may vary by State or City, but the general liability remains.

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The signs and other control devices, referred to or shown in this text are merely representative of a much larger and comprehensive number of applicable controls.

Roads Closed to Traffic

The most comprehensive type of public traffic control and protection is required in cases of complete shutdown of roadway sections for reconstruction or maintenance. Whether the roadway section to be closed is rural or urban, extended or short, the alternate route, or detour selected to replace it should meet these two obligations: It should completely bypass the section of highway closed, providing access to residences and business properties previously served via the original highway; and it should have the capacity to absorb and otherwise accommodate all normal diverted traffic volume without unreasonable delay, restriction or hazard. The volume and composition of diverted traffic, the roadway alignment, number and widths of available lanes and desired vehicular speeds are important factors in planning the detour.

Installation of Control Devices

There are three general parts of a detoured road project requiring informational guides and traffic controls: The approaches, the beginning and end of the closed roadway section, and the detour route itself.

Rural Detours: Figure 1 illustrates an extensive section of typical rural highway closed for reconstruction, and shows the detour route selected to provide a long-term run-around for the project. Because of two small towns that are included along the closed highway section, the detour route must connect with feeder roads to each town.

The minimum requirements, by location and type of each traffic informational and protective sign and device, are illustrated and discussed below for the approach, job extremities and detour routes.

Approaches: Every effort should be made to warn and slow down the driver far in advance of the closed roadway section. Information on speed reduction, road closure and the change of route can best be accomplished by the use of distinctive

ANY INTERRUPTION of the present intense traffic flow, due to highway construction or maintenance operations, must be compensated for by alternate routes, either through or around the job site. Such re-routing must be as safe and expeditious as possible, otherwise high accident frequencies with heavy losses may result.

To be most effective, accident prevention should become a definite part of advance operational planning between the contractor, his insurance carrier, his sub-contractors, the Resident Engineer and the Public Works official who is directly concerned.

The "Manual on Uniform Traffic Control Devices" published by the U.S. Public Roads Administration, Washington, D. C., is used by most States as the standard for the installation of street and highway control devices and will be followed here.

ive signs, reflectorized for night visibility and easily understandable to the traveling public.

Taking Fig. 1 as an example, at a distance of 1500 feet in advance of the work area, an oversize diamond shaped sign 42 x 42 inches informs the driver of "Construction Ahead." If more than one message is required at this point, rectangular shaped signs should be used which are at least 40 inches wide. The next traffic control is a double sign placed 1000 feet from the job extremities informing the driver to slow down to "15 MPH" and turn off on the "Temporary Route 1000 Feet" ahead. At a point no less than 300 feet nor more than 500 feet from the end of the closed section, a third sign should read "Barricade Ahead."

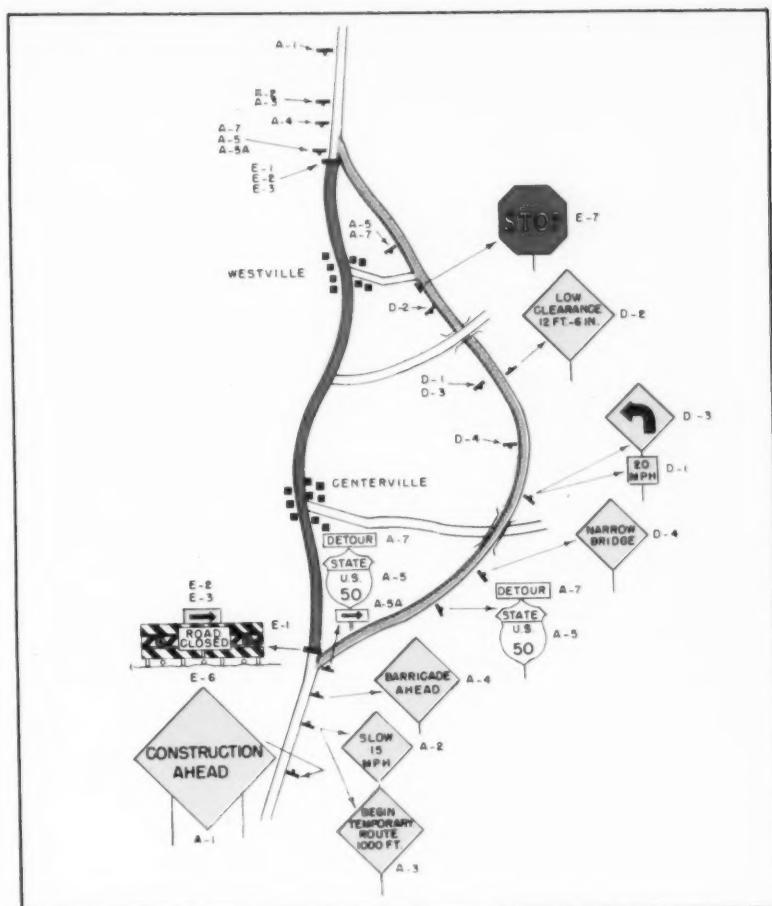
If a US or State Route number is assigned to the closed roadway, an additional sign should be posted within 75 feet of the point of route change, clearly indicating the turn and the route continuation.

The final precautionary measure to be taken at the approach is the complete removal of any center or lane-line markings which lead into the job extremities or points of closure. Such pavement lines should be diverted to lead directly into the detour route as a guide for approaching and turning traffic.

Job Extremities: The final control device to be used before a motorist turns into a detour route is a barricade. In order to exclude all through traffic, barricades should be erected entirely across the right-of-way and the shoulders in fence form. The barricades must be recognizable by distinctive markings such as diagonal striping in contrasting colors with a wide horizontal railing, with large red reflectorized disks and should include a mounted sign reading "Road Closed" and a large arrow pointing in the direction of the detour. In addition, flare pots, lanterns and other illuminating devices are essential supplements during hours of darkness, storm or other periods of reduced visibility.

Detour Route: Since the detour route is, for all practical purposes, an extension of the existing traveled right-of-way, it must necessarily duplicate the characteristics of the original route as much as possible. The detour, as mentioned above, must bypass the closed roadway section, yet provide access to adjacent residences. It must also accommodate the diverted traffic without undue delay or hazard.

The temporary route should be carefully posted as a detour, with



● FIGURE 1. This sketch illustrates the minimum requirements for location and types of informational and protective signs for a typical extensive rural detour.

temporary route numbers. Any additional information, which may guide and warn the motorist, such as safe speed limits, low clearances, bridge capacities, crossroads, bumps, dips, etc., is an essential part of the detour traffic control. These postings are, normally, the responsibility of the State, County or local authority. Some typical signs are shown in Fig. 1. Marginal delineators or guard rails may be required also.

In the case of extended detours, periodic patrolling may be necessary to enforce regulations, to check on the legibility of signs, to ascertain the adequacy of lighting and to detect any surface irregularities or hazards which may require correction.

The principles discussed for traffic control measures for approach, job extremities and detour route apply equally well on short-length projects. There is sometimes a tendency on the part of contractors or municipalities to be negligent with regard to the short detour routes.

However, experience indicates that the majority of serious and costly traffic accidents occur on short detours which have poorly maintained surfaces, steep grades and insufficient widths, particularly where the traveled way is being shared with the contractor's equipment.

Figure 2 shows a temporary run-around detour, such as may be required in cases of pavement collapse or washout, curve elimination, bridge failure, grade crossing elimination, and other relatively short-length road projects.

Urban Detours

A typical multiple-block detour in an urban area is illustrated in Fig. 3. The traffic control measures required at the approach, at the job extremities and along the detour differ considerably from those in rural areas. There is a greater concentration of street intersections, traffic and parking, as well as local rather than State jurisdictions.

Approaches: Because of the usual block arrangement in cities varying

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from 300 to 500 feet in length, advance warning of detours must be posted relatively close to the job extremities, usually in the middle of the adjacent blocks.

The black-on-yellow reflectorized sign in Fig. 3, which reads "Street Closed Ahead", posted approximately 100 feet in advance of the intersecting street preceding the point of closure, gives sufficient advance warning. In addition, a "Detour" marker, together with any "Route" markings, should be posted at least 75 feet in advance of the same intersection before the point of closure.

Job Extremities: At each point of the road closure, a barricade constructed across the roadway and sidewalks will serve to exclude all vehicular and foot traffic. In urban areas, horse-type barricades chained together to simulate a fence, are more commonly used than the fence-rail barricade because of their greater flexibility of handling. Alternate black and reflectorized white stripes combined with lanterns, reflectorized shields and flare pots will increase the visibility of barricades to motorists.

In addition to a sign mounted on the barricade reading "Street Closed", a "Detour" marker is also mounted, together with any route markings. Signal heads mounted at or near the job extremities should either be made inoperative or show a steady or flashing red signal face.

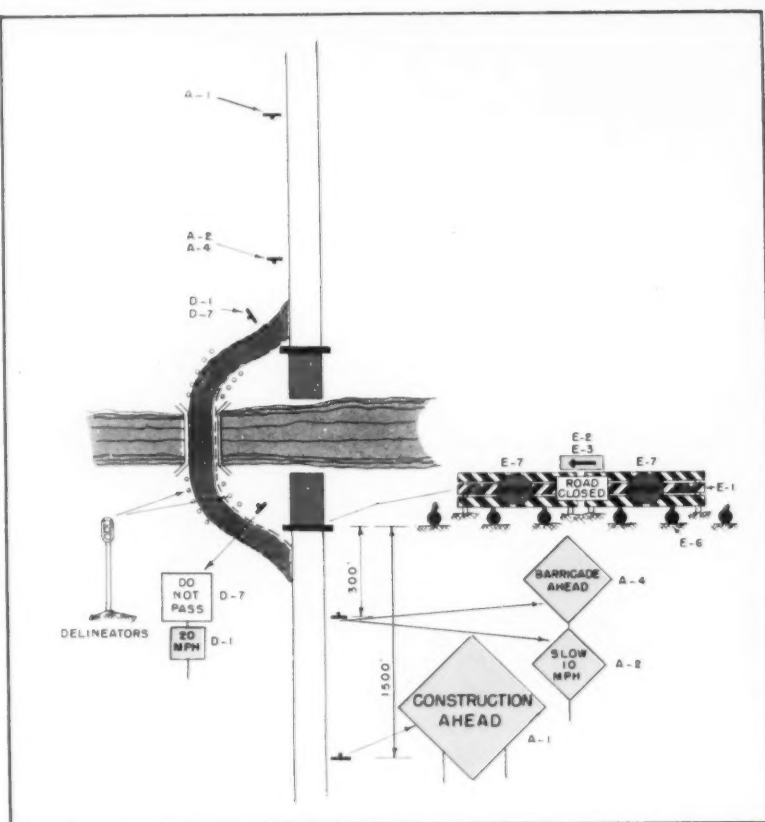
At the entrance of intersecting minor streets along the closed route, a secondary horse-barricade should be erected to permit limited access to the residences or business by local vehicles and pedestrians. Major cross-streets should be closed off entirely on either side of the route under construction, and posted for detour as described above.

Detour Route: A detour in congested urban areas must necessarily be as direct and open as possible. It

ROAD REPAIRS — TRAFFIC MAINTAINED

Many highway improvements must be carried out from beginning to end without interrupting the daily flow of traffic. It then becomes necessary to keep vehicles outside of work areas, yet at the same time guide them safely and smoothly through the project. In addition, construction schedules must be maintained and personnel must be protected.

Because the degree of exposure and potential liability increases greatly when public traffic and construction activities mix on the same



● FIGURE 2. This shows the location, spacing and type of signs necessary for a temporary run-around, as where a bridge failure or culvert washout has occurred.

is important, if traffic demand warrants it, that the detour street selected duplicate the street under construction in number of lanes, direction of movement, speed limits, accessibility, etc. It should parallel the closed through-way and be clearly posted as a "Detour" with such route numbers as may be necessary.

Single block detours are also common to urban areas. The types of traffic control measures described for multiple block detours are applicable, except in a lesser degree.

right-of-way, special precautions and measures are required. The public must be informed, at all times, of the conditions ahead. The contractor or Public Works Superintendent must plan operations and movements of construction equipment with extra care. In addition, the limits of work areas must be established with caution so that traffic lanes for public use are not obstructed or made hazardous.

The necessity of maintaining traffic movement through major or minor repair projects requires that

control measures at approaches, job extremities and through the work area be frequent, clear and strictly enforced. Such controls are designed, not to exclude traffic, as at detours, but to lead it gradually up to the work limits, steer it through its proper portion of the right-of-way and guide it without undue delay or exposure through the entire project.

Rural Repairs

Approaches: Night and day, warnings must be clearly visible to a driver approaching a section of road undergoing major improvements, advising him of conditions ahead at all times, and at a glance. At least 1000 feet in advance of construction on a straight stretch and 1500 feet in advance of a curving road a diamond-shaped sign should be posted on the right side of the road facing the driver bearing the legend, "Road Repair Ahead." Minimum size recommended for this sign is 42 x 42 inches. The warning message should appear in large black letters on a reflectorized yellow background. For added protection, a second sign reading "Barricade Ahead" and a third sign "Slow To 15 MPH"

should come into view about 500 feet in advance of the general repair area. A final sign, such as "Pavement Narrows" or "One Lane Traffic" should be placed some 200 feet ahead of the job site to notify the motorist of reduced road width.

Job Extremities: Traffic streams approaching the project are steered into each end, clear of the work areas with some form of physical channelization. Pavement transitions may best be indicated by setting up multi-colored reflectorized rubber cones, or lining up rows of mounted flags and lighted flare pots. This channelization or diagonal transition should be at least 150 feet in length for rural areas, terminating at the partial barricades positioned at each end of a job.

Closing off the work areas can best be accomplished by the placing of horse-type or A-frame barricades at each end and along the side exposed to traffic. Again, diagonal striping, reflectorization and lighting of the barricades are important. A standard "Stop" sign, combined with a "Wait For Signal" sign, should be mounted on, or just ahead of the barricades if the right-of-way paralleling the work area is reduced to a single lane requiring alternating movements under flagman control.

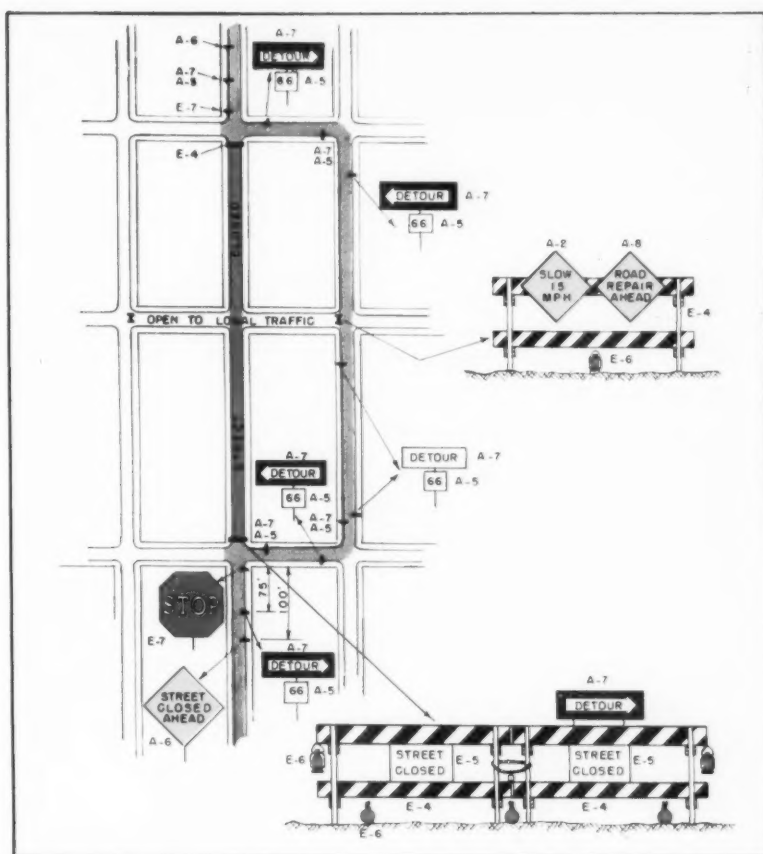
If the movement is to remain reduced to single lane operation during night hours, flagman control with lighted torches must necessarily be maintained. If the right-of-way paralleling the work area permits vehicles to pass safely, the barricade signs should read "Keep To Right" combined with a "Slow To 15 MPH" sign.

Work Areas: Constant guidance and protection are necessary to prevent accidents from occurring on the section of roadway reserved for public traffic. In addition to separating the work area from the traveled way with horse-type barricades, a number of warning signs may be required. These might include "Speed Limit"; "Truck Crossing"; "Road Machinery Ahead"; "Do Not Pass"; "Stop"; "Falling Rock"; "No Parking" etc.

Urban Repairs

While improvements on city streets may be quite extensive, the work must progress block-by-block with as little traffic interference as possible. Therefore, any traffic control measures adopted would be applicable to both major or minor repairs confined within a city block.

The intensity of demand for street space by the various traffic units in



● FIGURE 3 indicates procedure for a multiple block detour in an urban area. Requirements differ from those in rural areas at the approach and along the detour.

a central business district necessitates careful planning to fit work area limits into the complicated pattern. The movements of buses, trucks, passenger cars, taxis and pedestrians are usually so intermingled as to represent a composite traffic mass surge which reaches peak proportions between 7:30 and 9:00 am, between 12:00 noon and 1:00 pm and between 4:30 and 5:30 pm.

In establishing proper protective and traffic control measures at a given job site, consideration must be given to street widths, directional movements, curb parking, truck and bus loading zones, pedestrian facilities, commercial frontage and other work operations in order to keep interference and hazard exposure to a minimum.

In general, considerable cooperation is obtained during urban repair work. City officials will reroute traffic, eliminate parking and institute other emergency measures as may be required; merchants will make alternate arrangements for the pickup and delivery of their goods; and, pedestrians will accept certain

limitations such as reduced sidewalk widths or relocated crosswalks. Motorists will obey temporary restrictive regulations on speed limits, parking and reduced right-of-way. However, such cooperation is not always guaranteed, and even when obtainable does not lessen the responsibility of the Contractor or Public Works Superintendent to protect the public and his own employees from possible harm.

The number and type of protective and traffic control devices necessary for urban repair projects will depend on the location, traffic density, size of work area, equipment to be used and local conditions contributory to hazard. Generally, the approach and job extremities are so closely merged that traffic control measures can be applied interchangeably.

Protection Layout Patterns: Figure 4 illustrates general patterns of traffic protection and control for minor repairs at various locations along a typical city block, with each pattern including the approach, job extremities and work area. The work area should be kept small to

minimize interference with traffic and should be rearranged and shrunk as quickly as possible, especially at intersections.

Installation of Control Devices:

Traffic control devices such as signs, barricades, lights, etc., must be easily portable in order to provide the flexibility required to shift work areas quickly and form an adequate protective pattern around the job. The use of signs should be held to a minimum to prevent confusion. High level, portable battery flashers, self-revolving blades or flags are especially helpful in attracting the attention of approaching motorists to a warning sign.

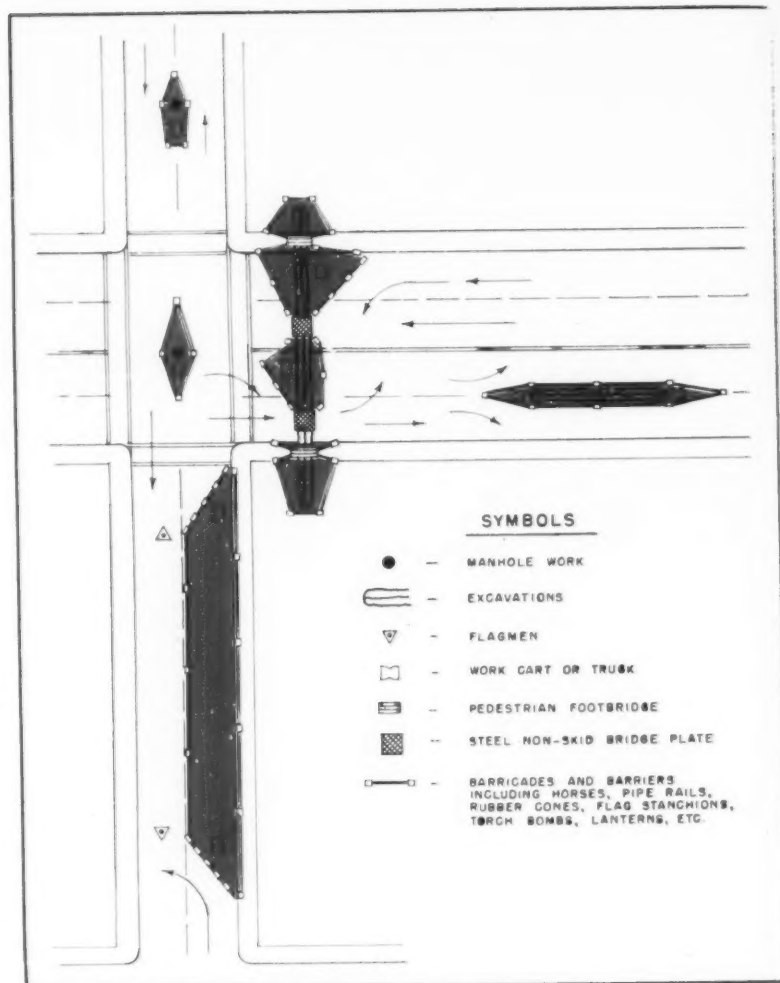
The most appropriate advance sign is one reading "Danger", "Men Working" or "Road Repair Ahead." Such a sign is located about 75 feet ahead of the work area if possible, or at the job extremities. To steer traffic around the project, some form of channelization is necessary, as the protective patterns of Fig. 4 indicate. Such channelization can be accomplished with rubber traffic cones, flags on stanchions or horse barriers placed end-to-end.

Pavement line painting is impractical in city work for channelization since it defeats the purpose and requirement of flexibility. Flares are sometimes used to establish a limit line, but should be raised to a height of 3 to 4 feet by means of drums. On small jobs, a truck or tool cart should be placed at the traffic approach end of the work area for further protection. Flashing lights afford the best approach warning.

The work area is separated from vehicular and pedestrian traffic by simple horse-barriers, pipe rails and/or traffic cones. In the case of deep excavations, fence barricades with 3 to 4 wide rails are the best separation. The lower rail, set at street level, can serve as a toe board for the spoil bank.

If the work area occupies at least one traffic lane so that vehicles coming from either direction cannot pass simultaneously, a flagman or police officer should be assigned to direct alternative movement of cars. Accessory portable signs may facilitate traffic movement around a work area. These include "One-Way" arrows mounted at the approach intersection; or "Keep Right" or "Left"; or "One Lane Traffic." "Danger" signs may also be included along the work area to a point where equipment or materials may encroach on the traveled way at intervals.

When the work area cuts across traffic streams, as in Fig. 4, special



● FIGURE 4. When street construction, including excavation, is under way, devices for traffic protection and control should be provided, essentially as shown.

provision must be made to provide traffic lanes across any excavation or difference in pavement grade. Steel plate or heavy planking can be used to bridge any street opening to permit traffic to cross without interference to work operations or exposure to workmen. On paving jobs, care must be exercised to eliminate sudden grade differentials on the traveled way. Sharp differences between old and new pavements, or raised manholes, must be clearly indicated by reflectorized delineators or barricaded and lighted to prevent the possibility of being struck by vehicle wheels.

The most common source of damage claims arises from pedestrians walking near or through a work area. Definite measures must be taken to provide separate facilities for pedestrian movements. Even the smallest excavation or obstacle must be made hazard-free. Barricades, foot-bridges, adequate illumination

and other special precautionary measures can be applied to lessen liability. In addition to keeping tools, ropes, pipe and spoil banks away from pedestrian traveled ways, shields should be erected to reduce possible injury or damage from flying stones, hot asphalt, welding sparks or other hazardous materials and operations.

Sign Maintenance

Despite the most comprehensive use of traffic signs and devices on road building jobs closed to traffic, accidents may continue to occur. The major reason for such occurrence has been traced to a misunderstanding by the motorist of the intent of a posted sign, resulting usually from illegibility, obsolescence or improper location. In rural areas, particularly, an accumulation of dust and grime can reduce the reflectivity and legibility of a sign to near zero visibility. Also, a cheap-



● **CROSS-OVER** at bus stop, with guiding barricades, can reduce accident potential.

ly fabricated sign will deteriorate quickly due to weathering. Unless mounted properly on posts, even the best fabricated sign may become loosened and fall. These facts emphasize the need for periodic maintenance of all traffic signs and devices used on the approaches, job extremities, detours and work area routes.

Equally important is the relocation of signs as needed to keep up with job completion. As each section of a road is opened for traffic, and the point of job extremity is moved ahead, the informational and warning signs should be moved accordingly. Nothing breeds contempt for posted signs quicker than false information to a motorist. If a sign informs him that the detour begins 800 feet ahead, he will slow down. However, if the detour is advanced any considerable distance without advance signs being revised, considerable ill-will can be created.

In addition to regular sign maintenance, the traveled way should be checked periodically for surface irregularities and other potential hazards to the public. A trustworthy, reliable man, provided with a pick-up truck should be assigned to maintain, relocate and check signs; place flares, delineators and visibility aids; and check hazards throughout the entire job site, recording the time of inspection and signing his name. An important consideration is that the shapes, sizes and colors of the signs as recommended be followed. They represent the most widely-used sign types and are most familiar to the majority of motorists.

Under conditions of darkness, storm or limited visibility, proper lighting of posted signs, barricades, work equipment and hazard locations is of prime importance. Signs, barricades and other control devices should be painted in distinctive contrasting colors with the lighter color

reflectORIZED to catch any source of light. Reflector buttons are commonly used to emphasize sign lettering, to outline barricades or form edge delineators for roadway or work areas. Oil lanterns and pot torches are best used to emphasize danger points, but are not considered as adequate illumination when used alone.

Work areas and other areas of potential danger or hazard require a high degree of illumination by means of floodlights or other luminaires. Police or flagmen directing traffic should wear reflectORIZED crossed belts and carry portable electric flashlights.

Good housekeeping of materials and controlled supervision of equipment movements will build good will and minimize damage claims rising out of injury to persons and destruction of property.

Enforcement is especially necessary on sections of roadway under major or minor repair but open to public travel. Flagmen, police officers or watchmen should be assigned to direct traffic as necessary. In the case of alternating one-way movements over long stretches, visual or audible means of communi-

cation should be provided. A pilot car is one of the best means of guiding-alternate opposing traffic through the work area and avoiding directional conflicts on complicated or hazardous routes. A simple, yet effective means of communication is the passing of a baton by the last motorist in a given direction to the flagman handling the opposite direction of traffic flow.

Specific rules for proper flagging operations are available from State Traffic Commissions, State or Local Police, Insurance Carriers and their sources.

Completion or Suspension of Project

A large percentage of equipment collision and loss-of-control accidents have occurred during periods of job shut-down. Principal causes of such accidents are neglect to make stored equipment inoperative, promiscuous storage of building materials or wastes off the traveled way and lack of visibility aids during hours of darkness.

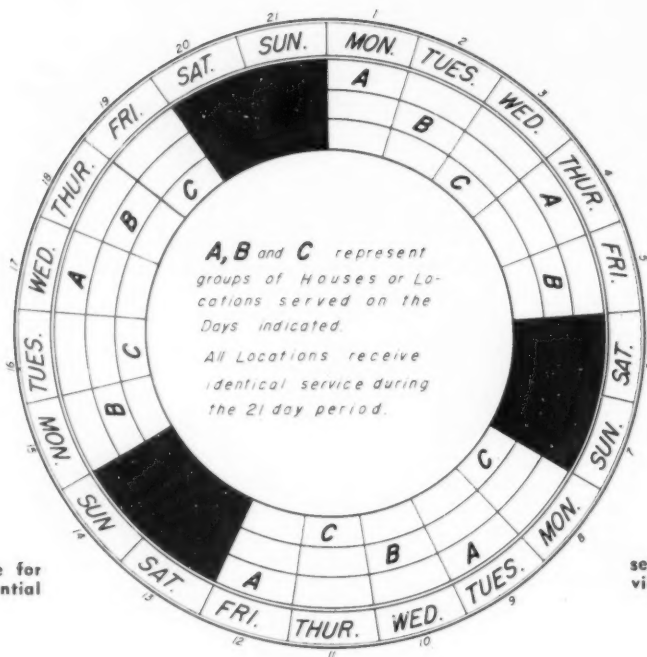
Upon completion and relinquishing control of a road building project, prompt removal of the job-site structures, equipment, signs, aggregates, and other contractors' items will eliminate the possibility of vandalism, personnel injury or property damage. Any area opened for vehicular or pedestrian travel should be cleared of rocks and other debris and waste or discarded materials.

In urban repair work, extra precautions are necessary to eliminate accident exposures during non-working hours. Excavations either must be temporarily covered with wood or steel planking or be completely fenced off with proper lighting from sundown to sunrise. In areas of concentrated traffic, police control may be necessary for a few hours after cessation of work.



● **NARROW** street and heavy traffic requires services of flagman to protect workman.

REVISED SCHEDULE STREAMLINES GARBAGE COLLECTION



● CHART shows schedule for refuse collection for residential

sections. Two collections are provided over each 8-day interval.

The City of Winston-Salem streamlined its garbage collection system effective July 1, 1958 after a year's study by the Sanitation Division of the Public Works Department. The new garbage collection methods promise to provide a more equitable schedule of garbage collection, a more efficient service to every residential area and an annual saving of at least \$50,000.

THEODORE H. NOE

Superintendent of Sanitation,
Winston-Salem, North Carolina

THE Winston-Salem sanitation division provides three types of collection service: (1) Collection in residential areas; (2) collection in the main business district; and (3) a Dempster - Dumpster collection system.

Under the system followed prior to last July, 31 trucks, including 18 compactor and 13 scow dump trucks, were in use. Three men and a driver were assigned to the compactor

•Editor's Note: Mr. Noe received a Master's degree in Public Health from the University of North Carolina in 1947 and has done public health work in Iran and with the Wisconsin State Department of Health. He is presently employed as the Superintendent of Sanitation of the City of Winston-Salem.

trucks which varied in size (9, 12, 13, 15, and 16 cubic yard capacity). Two men and a driver were assigned to the scow trucks. The normal work week was a five-day, 44 hour week with four nine hour days and an eight hour day on Friday. The collectors pick up all garbage and collectable household refuse from the rear of the premises and transport it to the sanitary landfill.

Before last July collections were identical every week. Area A was collected on Monday, Area B on Tuesday, and Area C on Wednesday. On Thursday the Monday collections were repeated. Repetitions of both the Tuesday and Wednesday collections were crowded into Thursday afternoon and Friday.

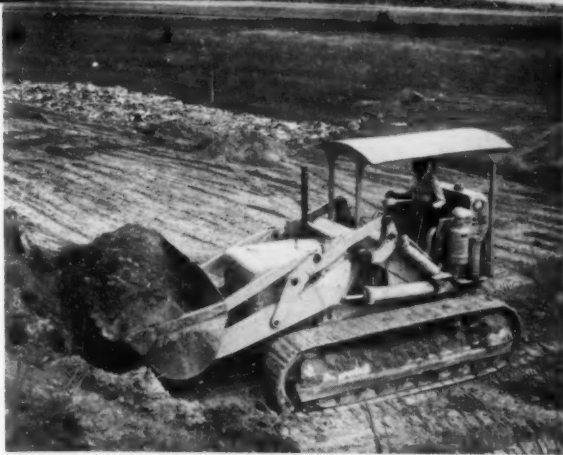
The result was that areas collected on Wednesday were collected again either one or two days later. On the second weekly pickup the

collectors usually found many empty or almost empty cans.

Collection Routes Surveyed

The normal growth of the City and the annexation of 10 square miles on January 1, 1957 indicated the need of major changes in the collection routes. It was hoped that the factual information obtained from a survey could serve as the basis for planning revisions in the routing and scheduling of the collection system. Accordingly, a detailed survey of existing routes was started in July, 1957.

To conduct the survey, the city employed a young college graduate to ride each garbage truck in town for a period of one week. He kept a record of the number of loads, the number of pounds hauled, the number of pounds per collection and the average number of pounds per



● REFUSE disposal is by sanitary landfill. Traxcavator compacts refuse, borrows cover and spreads and packs it over refuse.



● MODERN refuse collection units, like this one, are important in providing efficient sanitation service at a saving in cost.

house. He also recorded the mileage and time each truck spent (1) between the City Yard and its route, (2) on its route, and (3) from the route to point of disposal.

The results of the survey of the Winston-Salem collection system were not flattering. However, they were factual and indicated many areas of needed changes and desirable improvements in routing and collection methods.

The survey revealed that 36,577 family units (including 828 local business establishments scattered within the various routes) were being served. The routes varied as to number of family units from a low of 1079 to a high of 2090. The average for each of the 31 trucks was 1463 units per route.

The average house in Winston-Salem had 20.18 pounds of garbage on Monday, 19.30 on Tuesday, and 18.63 on Wednesday. The average dropped to 11.24 pounds on Thursday and to 9.71 pounds on Friday.

The survey indicated that those houses from which garbage was collected on Monday and Thursday were receiving excellent service. The Tuesday group of houses had a reasonable interval between collections also. However, the houses which received a pickup on Wednesday were scheduled for a second collection on Friday. These houses received less satisfactory service as they received no material benefit from this second collection.

Because of this disparity in service, it cost the City of Winston-Salem \$10 to \$11 per ton to collect garbage from Monday through Wednesday. By Friday the cost jumped to \$16.41 per ton because of the small amount of waste available for collections.

New Collection System

Under the new collection system the city has three residential garbage collection areas designated A,

B and C. The days when garbage is collected vary according to a three-week schedule. Every dwelling unit in town receives at least two collections every eight days. There is only one week in three when any area gets only one collection.

During the first week of the schedule, Area A is collected on Monday, Area B on Tuesday, Area C on Wednesday, Area A again on Thursday, and Area B again on Friday. No collections are made by the Sanitation Division on Saturday as the division continues to work a five-day week.

When the second week begins, refuse from dwelling units in Area C which had only one collection during the previous week, is collected on Monday. Area A is collected on Tuesday, Area B on Wednesday, Area C again on Thursday and Area A again on Friday.

The third week begins with refuse from Area B, which had only one collection the previous week, being collected on Monday. During the next four days, Areas C, A, B and C are collected in that order with Area A getting only one collection during the week.

In the fourth week, the three-week collection cycle starts all over with Area A being collected on Monday. Simply stated, the schedule provides that the areas are collected in ABC order. The only breaks come on the weekend or on a holiday. In case of a weekend the order is resumed on Monday. Following a holiday, the order is resumed on the next regular working day.

As a result of the new collection system, the number of trucks has been reduced from 31 to 25. Instead of 13 scows and 18 loadpackers, the city now operates 5 scows and 20 packers. The unused equipment is available in case of breakdowns. This reduction in the number of trucks in operation has permitted

the working force to be reduced by 16 laborers.

Some of the savings are being used to increase further the efficiency of the garbage collection system. First, some of the scow dump trucks and older packers were replaced by four new 20-cubic yard compactors. Second, two diesel crawler tractor shovels were purchased for operations at the sanitary landfills. Third, all employees of the sanitation division were furnished coverall type uniforms lettered to identify them as Public Works employees. Fourth, all sanitation employees were provided rain suits in order that they can continue their work during rainy weather. Fifth, a sanitation officer attached to the Public Works Department and another route foreman were hired. Sixth, additional Dempster-Dumpsters were secured for use throughout the city.

A Minimum of Complaint

Winston-Salem homemakers evidently find the new system to be a more equitable schedule of garbage collection. However, during the first few weeks housewives had some difficulty remembering when the garbage man was coming. As the three-week rotation system has become generally understood, complaints and calls have declined.

Summary

Winston-Salem's new streamlined garbage collection system has been in operation since July 1, 1958. Under the new system every dwelling unit in town receives at least two collections every eight days. The days when garbage is collected rotate according to a three-week schedule. The new collection system promises adequate and equal treatment to all residents, more equal work loads for the collection crews, and financial savings for the taxpayers of Winston-Salem.

STREET LIGHTING PROGRAM

WILL ADD 6,500 UNITS

A DECISION was made in 1954, by the City of Newark, N. J., to inaugurate an overall street lighting improvement program, based upon good street lighting practice. The program was set up as a group of five-year plans with definite objectives to be accomplished at the end of each period. The current five-year program will increase street lights from 7,500 units to 14,000 units.

Primary business areas will be illuminated with the use of fluorescent luminaires mounted on aluminum standards. Secondary business streets will have mercury vapor or incandescent luminaires mounted on aluminum standards. In many cases the luminaires will be controlled by photo-electric switches. Not to be forgotten, the residential areas will have incandescent luminaires installed on both wood poles and aluminum standards. To date, the major installation has been the new fluorescent white-way installed on Broad Street. Originally Broad Street, Newark's main thoroughfare, had 178 (15,000) lumen incandescent luminaires installed on steel trolley poles. These steel poles had no set pattern and when the new aluminum standards were installed, this was corrected.

Broad Street Lights

The following are the basic characteristics of the Broad Street installation: Total units, 218; mounting heights, 30 ft.; spacing 85 ft. on opposites; luminaires, 21,000 lumen fluorescent; average foot candles, 1.22; the street width is 92 feet.

At 38 different locations, a combination traffic and street lighting standard was installed. This was accomplished by a mutual agreement between the City and the public utility, Public Service Electric and Gas Co. of New Jersey. This combination standard was used in an effort to "clean-up" the corners. Because of dual jurisdiction, many times a street light standard and traffic signal standard are installed adjacent to each other. This type of installation clutters the corner but many times this must be done due to dual jurisdiction and

separate ownership of the equipment.

When possible, wait-walk signals were also installed on the aluminum lighting standards. These dual pur-

pose standards were made from heavy wall aluminum tubing especially designed to carry the extra weight and wind load of added equipment.



● **BEFORE** lighting improvement, Broad St., Newark, utilized 15,000-lumen incandescent lights. The result was a dull street with limited visibility for travelers.



● **AFTER** lighting improvement, visibility was excellent. Lights are 21,000-lumen on tapered aluminum standards. Unit in foreground supports traffic sign and light.



● GROVE HILL bridge, on Route 340 in Page County, Va., is a good example of a structure designed for to-day's traffic.

SITE PLANS FOR BRIDGES

J. N. CLARY,
Bridge Engineer,

Virginia Department of Highways

BEFORE beginning the design and preparation of plans for any bridge the designer should have available to him all pertinent information relating to the task to be performed. This should include:

- 1) Complete information as to the physical characteristics of the site on which the structure will be built.
- 2) Design criteria such as geometrics and design loading.
- 3) Geometrics of the road approaches to the structure.

The Site Plan, sometimes referred to as a "Situation Plan", should include: 1) Complete topography; 2) stream data; 3) waterway determinations; 4) subsurface exploration; 5) availability of local material; and 6) special information.

Topography

Complete topography should be surveyed and plotted and should cover an area having a length appreciably greater than the probable length of the proposed structure and a width extending beyond the toe of slope of the approach roadway fill. The width should also be sufficient

to permit some shift in location centerline without a new survey being required. This width should be at least fifty feet each side of centerline for a two lane road.

Elevations of the ground throughout the area are required and may be furnished and plotted either in the form of a grid or as contours. This data is normally plotted to a scale of 1 inch = 10 feet on continuous roll cross section paper.

Elevations for a grid are usually obtained by taking cross sections at 10 foot intervals along the centerline and at other points as necessary to have elevations 10 feet apart both longitudinally and transversely and at break points. Such elevations are usually taken to a tenth of a foot.

Contours, when this method is used, are normally secured by use of plane table and Wye level. The usual contour interval is 1 foot but a different value may be indicated in special cases.

The grid method has been used for years and is still used by many engineers. The Virginia Department of Highways decided several years ago that contours would be better suited to our purposes and this type of site plan has been adopted as standard.

The topography, in addition to the above, should include: All structures; islands; shoals; boundaries of wooded lands; buildings; fences and all works of man.

The site plan should include a profile along centerline to the same scale of the grid or contour plan and on this profile should be plotted the elevations of normal and high water. This profile should, if possible, extend for the full distance covered by high water.

A traverse of the stream should be made for a distance of 500 feet each side of centerline in order that its general course can be determined. Elevations along the bed of the stream are desirable to indicate its slope and if there appears to be any noticeable change in the shape of stream a few cross sections should be taken. If in the opinion of the survey party chief it appears likely that a relocation of the channel might be desirable he should so note and indicate the nature and extent of the recommended change.

If there is an existing bridge and there is any possibility that it will be used in the construction of the new bridge it should be accurately located and carefully measured. This will require extreme care and much

detail if it is to be fully useful to the designer. If the condition or location of the existing structure is such that it is evident that it will not be used in the new bridge the measurements may be taken with less care. The type and condition of the substructure should be noted. Angles between wings and body of abutment are important as are the widths of bridge seats, parapets, footings and tops of wings. Lengths of the wings and the length of the body of the abutment are needed as is the angle between centerline and face of abutment. The amount of detail necessary on the superstructure is largely a matter of judgment. An old steel truss, a through girder span or a timber superstructure would probably not be a part of the new structure. A deck type steel or concrete beam span might well serve and should be measured in considerable detail. The type of floor and its thickness should be recorded as should the type, size, length and spacing of beams.

Elevations should be taken on all parts of both superstructure and substructure such as top of roadway surface at centerline and curb, bottoms of beams, bridge seats, top and ends of wings and top of footing. Elevation of the foundation or the bottom of the footing would be desirable if it can be located.

Stream Data

It is in the determination of size and layout of a bridge that money may be saved or wasted. A knowledge of certain characteristics of the stream and the watershed is of considerable value in determining the size of the structure and the required amount of waterway area or opening under the bridge.

Every effort should be made to determine accurately the elevation of maximum high water. For larger streams throughout the country more or less accurate records of high water marks are kept. People who dwell near the smaller streams are often able to point out a spot to which the water may have risen during some record flood stage. In such cases it is well to make inquiries from a number of persons and from those longest resident in the vicinity where practicable. It is important to determine the date of any high water recorded in order that it may be compared with that of neighboring streams. This date will also make it easier to refer to other available data especially that published by the U. S. Geological Survey and by state units engaged in water resources activities.

In general a stream will overflow its banks at extreme high water and information to the contrary should be regarded as of doubtful value. Traces may be found of recent high water by deposits of mud and silt on trees and underbrush as well as in the accumulation of light drift. Heavier driftwood which does not perish by rapid decay often indicates the approximate limit of some earlier flood stage. Sometimes local residents will mark the elevation of high water by a relatively permanent method on some permanent structure in the flood plain. It is well to investigate this possibility.

It is important to be able to form some idea of the velocity at high water, for if the run-off per square mile or per acre is known or can be determined, it will be possible to compute the area of opening required. It is obviously impossible for the survey party to be present to determine the velocity at every high water, but usually some evidence can be found at the site to make a rough estimate of this velocity.

Erosion of the stream banks indicates a high velocity and the necessity of providing for such in the design of the structure.

Local residents may be helpful in estimating this velocity at the time of some recent flood. A fairly reliable method of determining this value is by examining the material to be found in the bed of the stream. Fine material indicates a low velocity while large rocks would indicate a much higher value. Tables in several old handbooks such as Merriman's "American Civil Engineers' Pocket Book" give the limiting velocity for stability of various materials. Since this velocity is that at the bottom of the stream it should be multiplied by approximately $1\frac{1}{2}$ to obtain the average velocity.

Among the information which the survey party should obtain and record on the Data Sheet accompanying the Site Plan are:

- 1) Is the stream flow swift, moderate or slow. (a) Estimate velocity at high water.
- 2) Amount and character of drift during flood.
- 3) Amount and character of ice.
- 4) Do breaks or bed show evidence of scour either under or downstream of bridge.
- 5) Has present bridge been in place at time of extreme high water.
- 6) Has a bridge ever been washed out at or near the proposed location. If so what part or parts.
- 7) Nature of material in stream bed.

8) Is there evidence of harmful chemicals in the water.

9) Are the banks smooth; lined with trees or boulders.

10) Does the surrounding ground confine the stream at normal water, or is it flat and swampy.

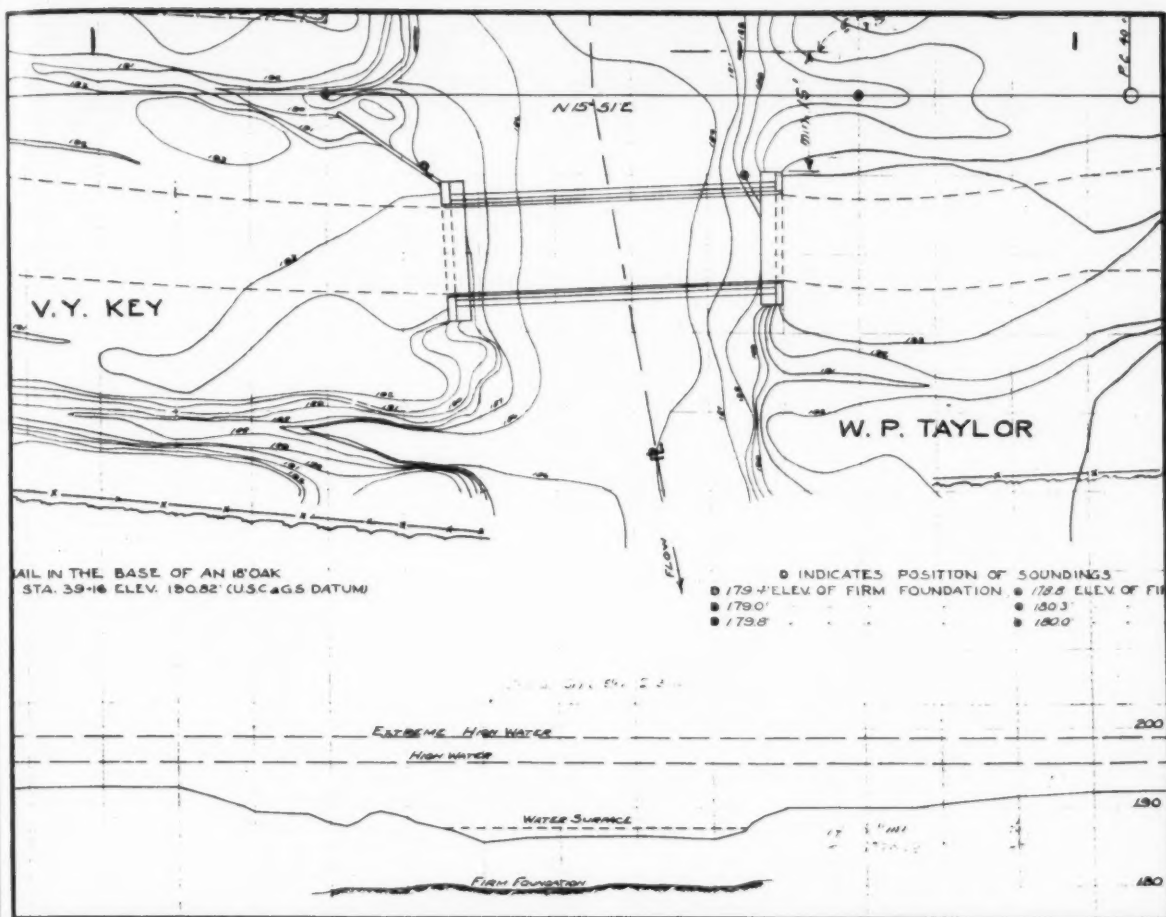
An effort should be made to determine the direction of the stream at high water especially if it is substantially different from that at normal water. This is important in selecting the type and skew of the substructure.

Waterway Determination

Data from existing structures may be very useful in determining the waterway necessary in the proposed bridge. Old bridges near the site should be measured so that the area of the waterway existing at such sites may be determined. The measurements should be sufficient to show a layout of the bridge, elevation of the bridge floor and underclearance of superstructure. The elevation of extreme high water with date of its occurrence is needed as is a cross-section of the stream under the bridge. The age and history of the structure are also important. The distance of the old bridge upstream or downstream of the proposed site should be noted and it should be ascertained whether the road approaches have been inundated. If so, a profile of the old road should be obtained for the full flooded length.

Any dams near the proposed site should be located and shown on the site plan or on a map to be attached to it. If the proposed bridge crosses above the dam a typical cross section of the stream below the dam is needed to assist in determining the required waterway opening. For the same reason it should be noted whether the maximum high water is caused by or affected by back water coming from a larger adjacent stream.

The area of the drainage basin above the crossing should be determined. This can best be determined by outlining and measuring the area on maps prepared by the United States Geological Survey or similar accurate topographic maps. Where available, aerial photos are useful for this purpose. The character of the drainage basin is quite important. The percentage of forest in the area has a considerable influence on the run-off and an accurate estimate of this should be made. Any other effective ground cover and its extent should be noted. The slope of the various sections of the area as well as the shape of the



● LOCATION map showing land ownership, contours, water and foundation elevations and recommended grade at El. 203.

basin materially affects the discharge and should be determined. This may be determined from topographic maps supplemented by field observations.

Subsurface Exploration

Too much stress cannot be placed on the importance of thorough subsurface exploration. While the more accurate and detailed borings necessary cannot be done by the normal survey party, preliminary investigations should be made to determine the depth and suitability of foundation material. If rock foundation is present and not at a considerable distance below the stream bed or the ground surface adjacent to the stream the rock profile may be easily determined with a reasonable degree of accuracy by means of a sounding rod supplemented, if necessary, by some shallow test pits. The character of the material overlying the rock should be noted since it may not be necessary to extend the structure all the way to rock.

If rock is not present, sounding

rods or an auger may be used to explore the character of the foundation material. All of the area likely to be covered by the proposed structure should be explored. Since firm clay or a bed of sand or gravel of considerable depth may provide a satisfactory foundation the auger will give more positive indication of the situation than will a sounding rod. An experienced operator may often be able to tell by the "feel" of the rod the character of the material being penetrated. Clay which can be penetrated will normally yield smoothly while the rod is moving but clings to it and tends to resist initial movement either up or down. On the other hand, sand and gravel produce a gritty sensation as the rod is being worked through it. Such soundings should not be relied upon too strongly and some test pits may be advisable for verification. In any case, for larger structures, additional and more complete foundation information must be obtained by use of specialized equipment.

Where the ground and stream bed are soft and of such a nature as to indicate the need for piles, this should be noted. If possible an estimate of the length of piles needed should be given. Such information may be obtained from local builders who may have driven piles in the vicinity.

Local Material

The availability and quantity of local material suitable for concrete aggregate should be noted. The location of local quarries or deposits of stone suitable for rip rap or masonry is important. Local availability of lumber suitable for forms, false work or other needs is also desirable. The location of the nearest railroad station or shipping point is useful information.

If the Site Plan with essential data is completed with care and accuracy the design engineer may proceed with confidence to prepare plans for a bridge which will properly and adequately serve the purpose for which it is intended.

SEAL COATING BY COUNTY FORCES

IN THE PAST, seal coating of bituminous mats had been sadly neglected in Douglas County, Wash. This was not necessarily by design, but largely because funds available would not stretch to meet the demands of new construction and at the same time allow for preventive maintenance. There are some 1763 miles of roads under the Douglas County road department.

In the past ten years we have been attempting to correct this situation, particularly in the Columbia River Valley area, which is the

PAT THOMSON,
Douglas County Engineer,
Waterville, Washington

fourth fastest growing area in the State. This area is highly suburban in character, with numerous short streets. Contractors either did not want to cope with these short street problems or else prices were away beyond reason. Thus, the county road department entered the seal coating process.

A bituminous crew has been developed in the past ten years. Now seal coating procedures are cheaper in operation, faster in method and more efficient in procedure for our type of work than contracting. This would not necessarily be true of other types of bituminous operation; but in our seal coating work, necessity and lack of funds have joined together into forcing us into the most efficient method for our case.

The photographs herewith show the construction methods and equipment used in our seal coating work.



● **FIRST** step, and the one that is probably most disliked by the operating personnel is sweeping the surface to be treated. It is necessary to remove all loose sand, stone and other debris; and this usually results in clouds of dust. Wetting is practically impossible, since the wet material cannot be broomed off the road.



● **ASPALT**, in the rural areas, is transferred directly from the transport vehicle to the distributor. Under these conditions, we request that the asphalt be delivered at 245° F. Then at our rate of shooting, the temperature at application, does not drop below 230° F. Here distributor is being loaded on a side road.



● **ELECTRICALLY** heated storage: The big tank heats at the rate of two degrees per hour and the small tank at the rate of 25 degrees per half hour. All seal coating is done with RD-5 asphalt. Transports make night deliveries to storage facilities so there are 11,000 gals. of hot asphalt on hand each morning.



● **USING** a Seaman-Gunnison 1250-gallon distributor, from 12 to 26-ft. widths are shot, depending upon the road or street. In the suburban areas, ordinarily one entire side of a street is shot before doubling back. On rural road work, we put out two legs before closing up, using about 0.3 gal. per. sq. yd. of RC-5.



● **JUNCTIONS** are numerous in the suburban areas. The shots are cut short of the intersections and then the connections are made by hand work. This prevents a doubling of shots and a bump at each intersection. This is an item that takes only a few minutes to do, but gives drivers a better riding junction.



● **COVER** stone used in Douglas County is a 5/8 to 1/4-inch lava basalt. This is a particularly hard rock which has an affinity for asphalt, resulting in a fine surface. Here a loader is shown working at a county stockpile, filling a 6-cubic yard dump truck for delivery to the spreader box located at the job.



● **COVERING** the oil shot is accomplished with a Hi-Way Traveler spreader box, which is a most efficient unit. Two men can operate it readily. With full augers, the operators do not have to shovel and it will spread from a single layer of stone to one 3 inches deep. We use a clean rock and like oil showing.



● **SEAL** coating requires certain specific conditions if it is to be of maximum utility. Hand work is a necessary evil. We keep one man following the spread with a shovel to remove or spread out small dumps of cover stone and prevent bumps in the surface. Here the shovel man is smoothing an aggregate spill.



● **ROLLING** is accomplished as soon after the spread as possible. In our work, we utilize a 13-wheel 8-ton Tampo pneumatic tired roller which is pulled by either a truck or a small tractor. Rolling immediately after asphalt placement seats the aggregate into the asphalt and gives a better bind to the shot.



● **MAINTENANCE** operations are carried on for three days following the spread. A patrol smooths out the aggregate displaced by traffic, using two flat wire brooms. During warm days, loose aggregate is taken up quickly by the asphalt, so that not much remains; but this is broomed off at once.

CONCRETE PAVEMENTS FOR CITY STREETS



● COMPLETED concrete pavement on Kenilworth Ave. at Deane Ave. overpass is a good example of construction practice.

HAROLD F. CLEMMER,
Engineer of Materials and Research,
District of Columbia

THE GENERAL theories of design and construction of rigid type pavements apply to pavements for both state roads and municipalities. However, there are many factors regarding pavements for cities that do not apply and need not be given consideration for state roads.

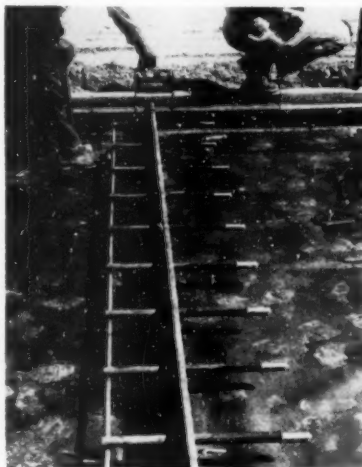
The interest and research that has been developed as to continuously reinforced pavements is most important and may bring about direct changes in design of pavement slabs that will prove of value and be economical. Also, research and experimental projects in England and this country have definitely indicated the value of stressed concrete (either prestressed or poststressed) in providing equal strength of pavement with much thinner slabs. The increased favor for the slip form method of constructing pavement slabs indicates that this method may become of importance. However, none of these ideas is particularly adaptable in the construction of city streets. With the many underground utilities that prevail in every city, and particularly in Washington, D. C., where even the power lines for street cars are under-

ground, there is need for frequent cutting into the pavement slabs. This destroys the effect of reinforcing when either continuous reinforcing or stressed concrete may be used. The use of the slip form method might apply for the construction of center lanes but would be difficult of application for widening and curb and gutter sections.

Due to the installation of various utilities, there is a definite problem of non-uniformity of soils founda-

tions. With the underground construction of the sewers; watermains; telephone, electric and gas lines; stormwater facilities, etc., the problem of back filling is extraordinary. Though each of the projects may comply with specifications, the results may prove very nonuniform. Specifications for soils for backfilling must permit the use of quite widely variant soils in order to include all satisfactory locally available material. It is important that special care be followed in the construction and compaction of the soils material, that is the soils "subbase", from a depth of 8 inches to a minimum of 32 inches (for the District of Columbia) to insure uniformity of support. The top 8 inches for soils base should be of the best possible available material and should be compacted to 100 percent of Proctor density.

The value of strictly complying with rigid specifications in the construction of soils foundations is fully recognized. Money spent to insure the proper soils foundation is wisely spent. A further practice to insure uniformity of concrete is the placement of subgrade paper or other waterproofing membrane on the soils base so moisture will not be unduly absorbed from the Portland cement concrete. This practice has proven



● DOWEL bar alignment in load transfer assembly checked with level on form.

of value in controlling the consistency of concrete and permits the use of a much drier, and therefore stronger and more durable concrete. This also is a factor in reducing friction between pavement slab and the soils foundation.

Length of Slabs

Concrete engineers are well informed as to the volume changes of concrete under both temperature and moisture conditions and the shrinkage of the concrete during setting when placed under varying temperature conditions. With this knowledge, the length of pavement slabs can be designed to insure against undue or excessive cracking. However, in the case of city streets there are many variables, as compared with those in state roads, including such obstructions as manholes, drainage basins, intersecting streets, sidewalks, alleys, etc. Therefore constructing long slabs (80 to 100 feet or more) is not practicable.

It is recognized that concrete is a material subject to volume changes and that significant random cracking of pavements will result as a consequence of such volume changes unless provision is made to control this cracking. It is better practice to adopt a design which will provide for regular and controlled cracking rather than permit random and irregular cracking.

By far, the best method to determine the proper length of pavement slabs is a survey, if practicable, of pavements constructed of approximately the same materials and under the same general conditions. Such a survey will provide definite information with which to check theoretical considerations of design of concrete and slab dimensions.

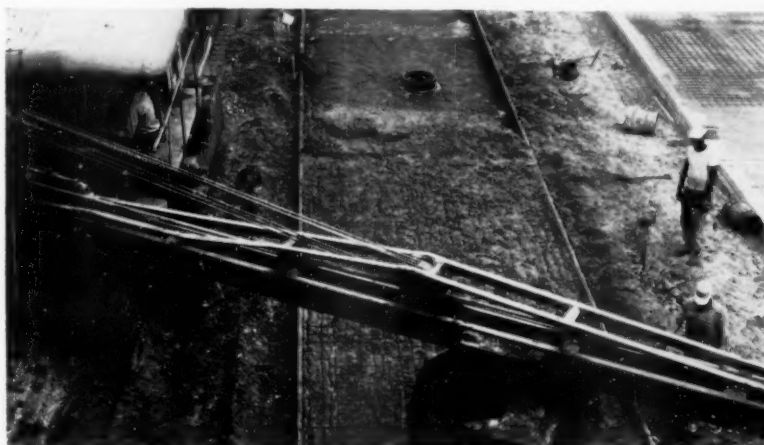
The results of this survey may be checked against a design formula giving consideration to the varying factors. The length of pavement slab is dependent upon the thickness of slab necessary to carry the specified loads, the thermal expansion of the concrete, the tensile strength of concrete, the coefficient of subgrade friction and other factors. As a result of surveys of existing pavements it was found that cracks and joints in rigid pavements in the District of Columbia averaged about 35 feet apart, while the theoretical analysis, considering 25 psi tensile strength at the time of significant contraction; an 8-inch slab which weighs 100 psf; and a coefficient of friction of two, indicated a slab length of 24 feet. A length of slab of 30 feet was believed satisfactory, particularly after considering the

cost of load transfer units and the required weight of reinforcing steel for this length of pavement slab. This length is now specified and has been followed for many years. Seldom, if ever, has there been evidence of structural failure between constructed joints.

It is generally conceded that the use of reinforcing is of direct value in all concrete pavements and bases. Reinforcing increases cohesion of each slab in the pavement; at first in curing stage when the concrete itself is least resistant to stress; and later if cracks occur, to check their further opening and prevent progressive failure. It is of particular value in distributing the shrinkage stresses which occur during hydra-

vided across all rigid pavement joints. This is accomplished by tie bars placed at regular intervals for longitudinal joints. However, free movement must be provided for all transverse joints.

It has been contended by some engineers that planes of weakness (without direct load transfer units) at intervals of approximately 20 feet will insure proper load transfer for concrete pavements at transverse joints. It has been determined, however, that joints opening more than 0.003 inch will not provide the aggregate interlock necessary to insure load transfer. If temperature at the time of placing, the length of slab, etc., is taken into account, some theoretical determination of the pos-



● PAVER is pouring a concrete slab on a Washington, D. C., street paving project. Note load transfer unit, subgrade paper in place, wire fabric and manhole.

tion or hardening of the concrete. Incorporated in the pavement slab, it permits the spacing of transverse joints further apart and the length of slab will depend upon the amount of reinforcing fabric used.

Cracks around manholes and similar pavement openings, such as light and telephone poles in alleys result from localized shrinkage stresses during hydration of the cement; they may be prevented by the installation of poultry wire (20# / 100 feet) for an area about two yards square around such structures. This practice has practically eliminated radial cracking around openings through the pavement slab in the District of Columbia.

Properly designed joints will assist in eliminating further cracking and will permit proper sealing to provide a pavement that will protect fully the soils foundation.

Load Transfer Across Joints

It is of direct importance that provision for transfer of load be pro-

sible opening might be made; however, direct dependence cannot be placed in this as many variations, such as the friction between soils foundation and the slab, affect this movement. Surveys show some planes of weakness remain tightly closed while adjacent ones open far more than the permissible 0.003 in.

Incorporation of a proper load transfer unit at all transverse joints is provided in the specifications recently presented by the American Concrete Institute for concrete pavements. Placing a load transfer unit across all joints more directly insures proper load transfer than the placing of planes of weakness at close intervals. The amount of movement of the concrete at joints will depend upon temperature at the time of placement and the extremes of temperature to which it may be submitted later, as well as the degree of friction between the soils foundation and the pavement slab. The ideal load transfer unit has not yet been designed, but recent im-

provements have been so marked that free movement of transverse joints may be expected when proper consideration is given their design and installation.

Sawing Pavement Surfaces

The sawing of joints should not be depended upon to create planes of weakness. It is practically impossible to so time the sawing of these joints as to meet the exact time that maximum shrinkage, caused by the setting of the concrete, may develop incipient failure and the concrete to crack due to this setting shrinkage. Surveys of many projects show transverse cracks in addition to the sawed joints and sometimes near the joints formed by sawing. This indicates that incipient cracks occurred at the time of maximum shrinkage during the setting of the concrete, with the cracking at the sawed joints at a later time. This process should be used only when provision is made to insure the development of a plane of weakness at the place of sawing.

The sawing of the pavement surface to provide a well for sealing contraction joints, which have been otherwise created, is satisfactory though somewhat expensive. The cost of providing for a plane of weakness is small but the importance so great that definite dependence should not be placed solely on sawing to create this joint.

Quality of Concrete

Highway engineers must follow the best design and construction principles in building our interstate system to insure against the need for realignment, reconstruction, etc.; it is even more important in the case of the heavily traveled city streets to construct the most durable and satisfactory pavement possible. Such streets are definitely located while alignment of state roads may be improved at a later date. It should be the policy of any municipality to insure smooth surface and long life of pavement with the minimum of maintenance regardless of cost. The cost of traffic delays on city streets is enormous and an inconvenience to the public. Heavy expenditures for maintenance oftentimes could have been minimized if proper attention had been given to the original design of the pavement slab and a little more money spent to insure maximum quality of construction.

The concrete of the pavement slab must develop sufficient strength, to support, under all conditions, the maximum traffic loads which may

be imposed throughout its entire area. It is generally considered that strength of concrete is the controlling factor and that all other factors affecting quality will prove satisfactory if there is sufficient strength.

Studies show durability of concrete, as determined by loss in strength from freezing and thawing, is greater for the richer mixes. The concrete of a lean mix is less dense and offers less resistance to disintegrating forces. A lean concrete shows greater variations in strength than a concrete having a greater unit cement content.

The required depth of pavement slab is dependent upon the unit strength of the concrete. A high cement content provides greater strength and durability of concrete and therefore requires less depth of slab than a leaner concrete.

To insure strength and durability of concrete, many factors must be considered. The general characteristics of the cement and aggregate should be studied in relation to the effect of local prevailing climatic conditions. The thickness of slab, amount of reinforcement and length of slabs, should be determined by theory supplemented by results of observation. Utmost attention must be given to the proper sealing of joints or cracks.

Base Construction

The presence of irregular surface cracks is undesirable, not only because of appearance, but more importantly because they represent structural failures. Inasmuch as cracks in the pavement surface generally result from underlying base cracks, moisture entering the surface will penetrate to the base, permitting further disintegration. This problem immediately suggests durability, which is a significant factor in all regions—in the south where repeated wetting and drying occurs; in the north where frozen subgrades may be the major problem; and in the more or less temperate areas where numerous freezing and thawing cycles may occur during the year. Design in the District of Columbia must be considered under the latter conditions.

It has been general practice in the construction of Portland cement concrete bases for bituminous surfaces to use a concrete mix having a low cement content. One of the reasons for the use of low unit cement content base mixes has been the desire to minimize volume changes of the base which contribute to its cracking and to subsequent failure of the bituminous sur-

face. In applying this principle of design, engineers have failed to appreciate the fatiguing influence on the concrete of a continuous slab as well as the extent to which lean mixes are lacking in durability.

The durability of the concrete is equally as important for a rigid base as for a concrete pavement. There is, without question, a definite protection afforded by bituminous surfaces in reducing temperature changes and therefore in reducing warping stresses. If the pavement base is divided into short slabs so that the movement at any one plane of weakness would be small, this movement would not be reflected to cause cracking of the bituminous surface. Recognizing this, the District of Columbia uses six bags per cubic yard for Portland cement concrete base rather than the seven bags specified for finished Portland cement pavements.

In order to control the volume changes of the concrete containing six bags per cubic yard (rather than four bags), the D. C. Highway Department places planes of weakness each 12 feet. This permits the use of 12½-foot sheets of wire fabric to be installed in each slab, leaving an overlap of 3 inches on each side of the plane of weakness. The shrinkage at these planes of weakness is sufficient to take care of the expansion which may occur under high temperatures unless construction is carried on at temperatures below 50°F, in which case expansion joints are installed at the tangent points or at minimum intervals of 300 feet. These planes of weakness are made in the plastic concrete by forming a vertical groove to a depth of approximately half the thickness of the slab, usually installing sub-grade paper which is left in place. The close spacing of the joints and the protection afforded by the bituminous surface assures against opening of the planes of weakness sufficiently to lose the interlocking load transfer effect. The greater the consideration given the temperature at which the concrete is placed and the range of temperature to which the concrete may be subjected, the more accurately may the length of the slabs be determined.

This practice of design and construction of rigid bases has proven very satisfactory and has entirely eliminated random cracking and minimized direct cracking at the plane of weakness. This method of design and construction of Portland cement concrete bases is accomplished with little if any additional contract cost. By permitting the use

of a greater unit cement content this design insures maximum durability without causing excessive internal stresses, the elimination of irregular and free corners at cracks which generally result in structural failures; and it provides a base of more uniform supporting capacity.

A further development in the construction of concrete bases requires that all Portland cement concrete bases conform to the design and construction for finished concrete pavements. The pavement base is divided into lanes and the slabs held together longitudinally by tie bars. The concrete is required to be finished by machine where practicable but is required only to meet 1/4-inch smoothness rather than the standard requirement of 1/8-inch from the ten-foot straight edge, as required for concrete pavements.

All Weather Concreting

If we are to accomplish the schedule for our present highway program, the season for construction must be extended to the maximum, and whenever possible, should continue throughout the year.

Paving practice which, in general, permits three days for curing of concrete, must oftentimes be revised to permit opening of pavement to traffic in 24 hours, particularly in municipal construction, without sacrificing assurance that proper quality of concrete is being attained. In general, specifications state that pavements may be open to traffic when the concrete has attained a specified strength of 550 psi. Where conditions may be controlled so that only light traffic is permitted to use the pavement, a lower strength (450 psi.) would be satisfactory. It should be realized that the soils foundation, the reinforcement, and other influencing conditions, are favorable at early ages and therefore maximum supporting value is provided for the pavement. In general, it is the practice to permit removal of structural forms when the concrete has attained 75 percent of its design strength.

When making use of Portland cement concrete for construction, proper conditions must be maintained to effect uninterrupted hydration of the cement in the concrete and to permit its hardening or gain in strength at the maximum rate. For such conditions, it is necessary:

- 1) To provide sufficient, but not excessive, water to insure adequate hydration of the cement;

- 2) To maintain a reasonably uniform temperature of the concrete

within a range that will insure proper hydration of the cement (probably 50° to 100° F);

- 3) To maintain the above conditions until satisfactory strength has been attained.

The importance of a low slump concrete so as to minimize porosity, is well known. It is important to be sure there is not a rapid loss of moisture from the concrete and that sufficient moisture is provided for the hydration of the cement until tests indicate that the specified strength has been attained. Some engineers depend upon the retention of the mixing water in the concrete to assist in curing. This retention may be accomplished by application of membranes to reduce the loss of water through evaporation. The specifications of the District of Columbia require preliminary covering with wet burlap for 24 hours, which may be followed by continued wet curing or by the application of flake calcium chloride. This latter method is of particular interest when it is desired to open the pavement to traffic at the earliest possible time. As the calcium chloride dissolves

- (a) By the use of high-early strength Portland cement Type III or III A in lieu of normal Portland cement (Type I or I A, or Type II or II A).

- (b) By the use of additional Portland cement (Type I or I A, or Type II or II A) in which case the total amount of cement shall not exceed 8 bags of cement per cubic yard of concrete.

- (c) By the use of calcium chloride as one of the ingredients of the concrete in an amount between 1 and 2 pounds of calcium chloride per bag of cement."

The general practice of the District of Columbia is to add one sack of cement to the designed mix and incorporate calcium chloride in amounts recommended according to climatic conditions.

The control of the temperature of concrete between the limit of 50° and 90° F is most important. During summer months, conditions for gaining early strength of concrete can be easily controlled and the use of calcium chloride will more than double the one-day strength normally attained. The use of additional



● BEAM tests are made on the job. Test specimens are taken of all concrete to determine quality of paving mixtures and to facilitate long-range quality studies.

and penetrates into the surface of the concrete, traffic may be permitted on the pavement surface without affecting the process of curing as would be the case with membrane or covering methods.

The specifications of the ACI Committee 617 on "Pavements and Bases" presents the following recommendations to attain "High Early Strength Concrete":

"High-early strength concrete shall be produced by one of the following methods, or any combination thereof, as specified in the special provisions.

cement and calcium chloride will provide practically 300 percent of that attained by a standard mix within one day. This permits opening of traffic lanes so that construction may continue without delays due to traffic.

High Temperature Concrete

The deleterious effect of placing concrete which is itself at high temperature may be as great as placing it when the concrete is at a very low temperature—that is, below the recommended temperature for proper placing. There has been con-

siderable study carried on in laboratories, the results of which have indicated the importance of not permitting the temperature of concrete at the time of placing to exceed 90° F. The D. C. Highway Department, due to the desire to obtain early strength of concrete for opening pavements to traffic at the earliest time (oftentimes within 24 hours), takes a great number of field concrete specimens, the test results of which offer interesting study. Comparisons may be made between various projects, various materials, and other construction variables. Test specimens are made for all concrete used by the entire Engineering Department, so that there are thousands of results and data on concrete beam and cylinder specimens each year. Results of these tests show concrete placed at temperatures of 80° to 90° F, develops maximum strength; and that concrete placed at temperatures of 100° F or over develops much lower strength; in fact, about the same as concrete placed at a temperature of 50° F or lower.

To control the maximum temperature of the concrete, it is of interest to consider:

- 1) The temperature of the cement being used; however, since cement has a low specific heat and there is a small amount proportionately used in a concrete mix, the temperature of the cement is not of great importance.

- 2) The temperature of the aggregates. The wetting of coarse aggregates will be of some value towards cooling the mix.

- 3) The important factor, however, as in the case of heating concrete, is to control the temperature of the water; in this case to lower the tem-

perature of the water. The ideal method of cooling water would be to install refrigerating coils in the water tanks; however, where high temperatures prevail for only short periods of time, this would be expensive. The use of crushed ice placed in the mixture at the time of mixing (from 50 to 100 lbs. pcy) has proven very effective. When high temperatures may prevail for only a short time, the use of ice will control the temperature sufficiently to assure proper conditions for the hydration of the cement.

Winter Concreting

The problem of winter concreting requires special attention whenever air temperatures may be below 50° F at the time of placing concrete. The use of calcium chloride will accelerate the hydration of the cement so that special protection will not be required until the temperatures are near freezing. In freezing temperatures, materials must be heated so that the temperature of the concrete will be at least 70° F when placed. Provision must be made for the protection of the concrete to assure that a temperature of at least 50° F is maintained for three days.

As stated previously, the most satisfactory method of controlling the temperature of concrete is to control the temperature of the water. This is easiest and effects the greatest results. There must be no frozen lumps in the aggregates and, if necessary, the aggregates should be heated to insure against freezing.

As with any chemical reaction, the hydration of cement is directly affected by any change of temperature. The lowering of temperature after placing of concrete directly reduces the rate of hydration of the cement. Placing concrete at 60° F when the temperature may fall to 40° F causes a definite slowing of the setting of the concrete; at 40° F with proper concrete temperature but with air temperature rising to 60° F, hydration will proceed normally. The specifications of the District of Columbia for winter concreting are:

"In lieu of whatever method of curing is being used, two pounds of calcium chloride per sack of cement shall be incorporated in the concrete mix as directed by the Engineer, whenever the temperature may be expected to reach 50° F or lower during the 24-hour period following the placing of the concrete. Whenever the temperature may be expected to reach 40° F or lower during the 24-hour period following the placing of the concrete, the aggre-

gates or water, or both, as directed by the Engineer, shall be heated. As soon as the concrete has hardened sufficiently to prevent marring, the pavement surface shall be covered with dry burlap, building paper or similar material for protection of concrete surface, upon which shall be spread at least six inches of dry hay, straw, or other suitable material. Proper provision shall be made to hold the material in place for at least three days or until field tests indicate that the concrete has attained the required strength.

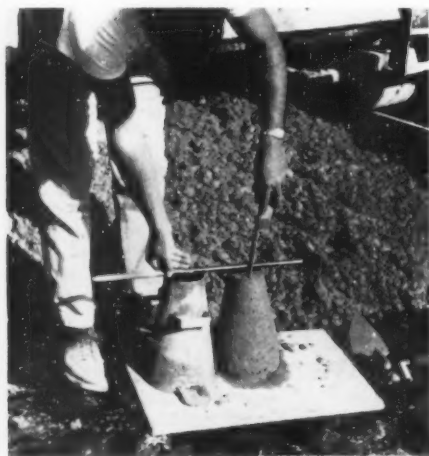
"Placing of concrete may be started as early in the morning as the contractor desires, but shall be discontinued at 2 PM so as to permit the setting of the concrete before the temperature begins to drop."

One of the problems of particular concern to a city is that of ready-mix concrete. Its use is very practical but its control as to quality is most difficult. The quality of concrete for each truck load is dependent upon the driver as a concrete expert. The use of a concrete spreader capable of spreading the concrete to the full width and depth of the pavement slab, should be made mandatory where the use of ready-mix concrete is permitted.

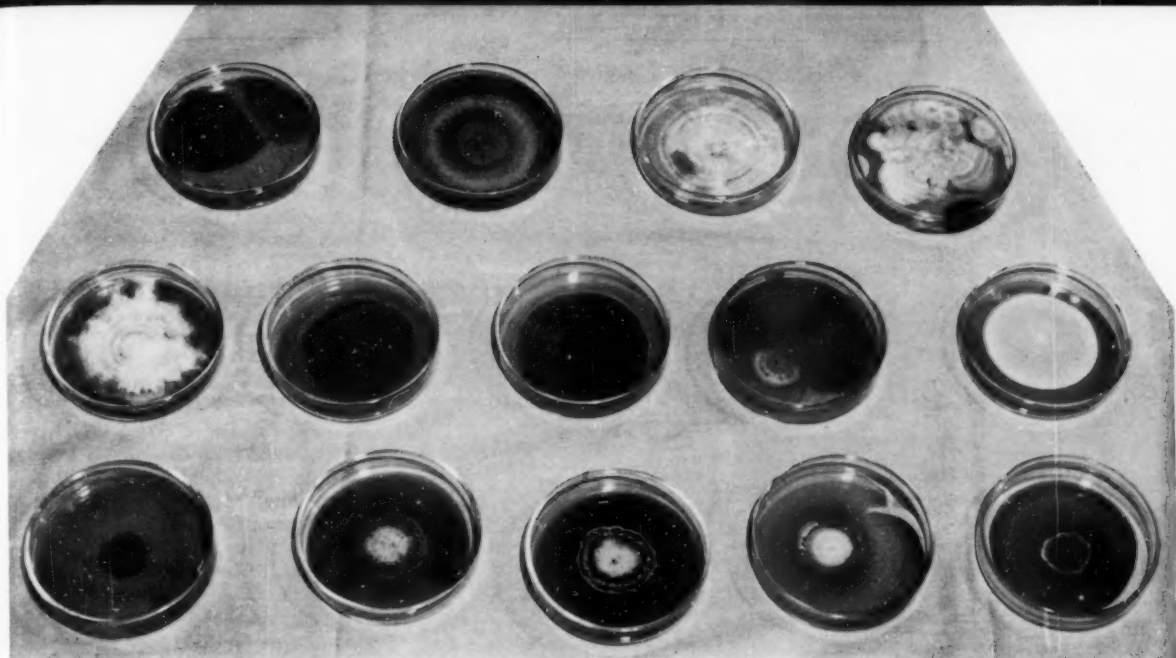
The discharge of concrete from a stationary paver by means of a chute, was prohibited many years ago in order to assist in preventing segregation of aggregates in the concrete. Unfortunately, a chute is the only means afforded for the discharge of concrete from a truck mixer, thus emphasizing the necessity for use of a spreader. State Highway Departments are cognizant of the many problems presented in control when ready-mix concrete is used on paving projects. The AA-SHO has recently published a specification on ready-mix concrete.

The value of placing concrete by means of vibration is worthy of consideration. Vibration is most successful with concretes of low slumps which does tend to provide concrete of maximum quality and durability. The cost of providing for vibration of concrete during placement is small when considering the benefits derived.

As stated, the matter of jointing is one of diverse opinions but it is the belief of this Department that rigid type pavements for municipalities should be constructed of comparatively short slabs, with well distributed reinforcement and properly constructed joints so that they will be structurally strong and may be properly sealed.



● EXCELLENT paving mix is indicated by uniformity and low slump on test.



Left to Right, Top Row: *Aspergillus niger*; *Trichoderma viride*; *Geotrichum candidum*; and *Penicillium melinii*.

Middle Row: *Penicillium ochro-chloron*; *Pullularia pullulans*; *Trichoderma viride*; *Fusarium oxysporum* and a contaminant; and *Penicillium lilacinum*.

Bottom Row: *Margarinomyces heteromorphum*; three Species of *Penicillium*; and *Fusarium aquaeductuum*.

- SOME OF THE MORE COMMON mold-type fungi found in sewage. *Geotrichum candidum* and *Fusarium aquaeductuum* are most prevalent. The rings in many of the cultures are of diurnal origin and usually result from light stimuli.

Are Fungi Important in Sewage Treatment?

The planned use of fungi for the stabilization of organic compounds in sewage offers intriguing possibilities. The role of these natural scavengers is being investigated by the Public Health Service at the Robert A. Taft Sanitary Engineering Center.

WILLIAM BRIDGE COOKE,

Mycologist,

In Charge, Fungus Studies,

*R. A. Taft Sanitary Engineering Center,
Cincinnati, Ohio*

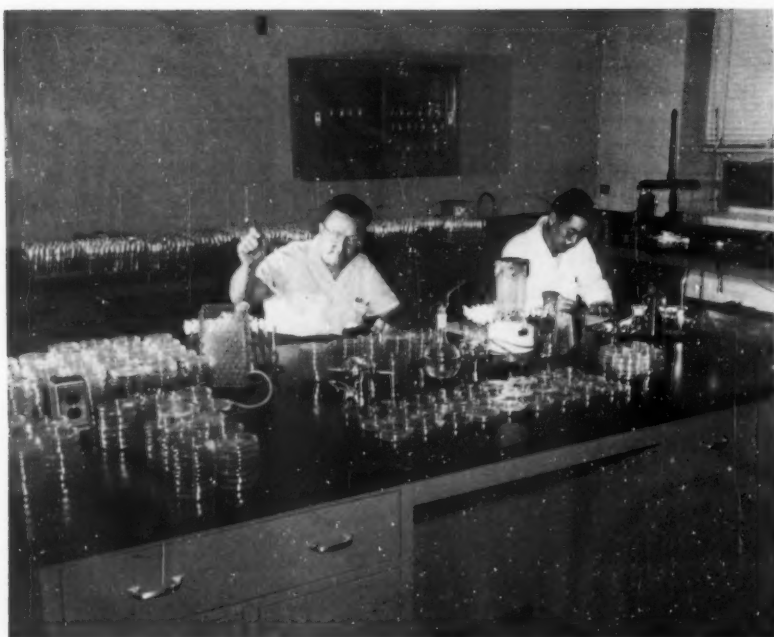
MOLD SPORES are numerous in the air about us. In terrestrial habitats they are produced in great abundance and may settle out of the air into water or onto the soil. Because of the prevalence of fungi, their frequent appearance in water is not surprising. However, little is known concerning the role they play in waste treatment, and the public health hazard or other harmful effects, if any, that may result from

their presence in contaminated water. The planned use of fungi in stabilization of organic compounds in sewage is an intriguing possibility. The Robert A. Taft Sanitary Engineering Center has been engaged in research to provide the basic information necessary for evaluation of the significance of fungi in water, and to develop methods for their intelligent use in waste treatment.

Most molds found in sewage and polluted water are widespread in nature and are able to use a broad series of naturally occurring substances as sources of food. Next to oxygen, the two most important elements required by fungi are carbon and nitrogen. In nature and in sewage, carbon requirements are met by several different kinds of simple

sugars. Nitrogen can be obtained readily from proteins, from various kinds of ammonium compounds, or even from nitrates and nitrites which are present. Only a few molds cannot utilize nitrates or nitrites as nitrogen sources; most common species can utilize ammonium compounds. Only rather specialized species of fungi can break down cellulose into decomposition products easily usable for carbon sources.

Those fungi which form partnerships with algae in nature to develop a lichen depend upon the algae for their vitamin supplies. Those fungi which grow in sewage treatment plants are independent of other organisms for their vitamin supplies. It is true that an occasional strain of a mold which grows in



● **TRANSFER** preparation technique is used to isolate pure cultures of fungi from samples collected at a sewage treatment plant. As many as 90 species of fungi have been isolated from various stages of a single plant. The author (left), a Sanitary Engineering Center mycologist, and his assistant, George Matsuura, are shown above.

sewage needs one or another vitamin from an outside source, but vitamin sources are abundant in sewage. Many chemicals are present including vitamins, and many sewage organisms may release these chemicals into the liquids around them by their own metabolic activities.

A relatively large group of fungi is associated, throughout the life cycles of its members, with the dung of various kinds of wild animals and even of man. Such fungi produce spores that can germinate only when they have been subjected to the activities of digestive juices. The spores germinate; the fungus grows and fruits on the dung of the animal which ingested the spores; and the spores are so discharged that they become attached to or associated with some blade of grass or other morsel an animal may eat. In sewage, polluted water and sewage treatment plants, no fungi are commonly found that require such a cycle of events in their life histories. An occasional species may be found which is involved in such a cycle, but such fungi are only chance invaders of the habitat.

Since the fungi which occur in sewage and sewage treatment plants are so widespread in nature, it would be only natural to assume that there may be an occasional species capable of causing disease. This has been shown to be true. A mold very

abundant in sewage is also a normal inhabitant of the human body, the "milk mold" (*Geotrichum candidum*) which is a contaminant of the dairy and the milk industry in all its phases. The blue-green *Aspergillus fumigatus*, a common species, is found in soils over almost all the world. This species is dangerous to man if too many spores are breathed into the lungs, where it can cause a rarely fatal pneumonia-like disease. One mold (*Allescheria boydii*), found only occasionally, causes the disease Madura-foot when its spores gain entrance to wounds in the lower extremities. To date, no disease conditions caused by fungi in sewage treatment plants have been reported among workers in those plants.

At present there is no evidence to show that if sewage effluents and liquids from various stages in sewage treatment processes were used in irrigation practice they would add to the inoculum of plant disease organisms already in the soil. However, plant disease fungi have come from various sources into sewage treatment plants and have appeared in sewage and polluted streams. It is not known whether the strains that have been found are actually pathogenic to plants, but this does not necessarily minimize the potential hazard to crop plants of using unsterile sewage effluents as irrigation supplements.

Many interesting kinds of fungi occur in sewage and polluted water, and the fact that they are able to increase in numbers in such habitats indicates that they are not necessarily strict soil-dwelling organisms. In addition to these fungi, the yeasts should be mentioned. A number of species of yeasts, including the red yeast, representatives of at least four genera of white yeasts, and two false yeasts (the milk-mold and the "black yeast" *Pullularia pullulans*) are common organisms which in certain parts of a sewage treatment plant or in reaches of a polluted stream may multiply rapidly and abundantly. It has been said that "yeasts" play no part in sewage treatment. However, the experiments on which such statements have been based were made with brewer's or baker's yeast, not commonly found in sewage. So-called wild yeasts have not yet been studied in relation to their ability to degrade components of sewage.

Many fungi have become adapted to sewage, polluted waters and sewage treatment plants as places in which to live. Within this series of habitats, certain complex chemicals are becoming more abundant as industry adds new products to its inventories, presenting complex chemical waste by-products to sewage and polluted waters. It is known that in nature certain fungi can utilize lignin as a carbon source. One of the important waste contributions of the paper industry to our streams is lignin in a modified form. So far molds which normally use natural lignin have not adapted to the form produced as a by-product of the paper industry. The group of compounds called "hard" detergents is another increasingly important source of trouble in the treatment of sewage and raw water supplies. It is hoped that certain fungi, in addition to being able to live with complex chemical waste products, may be able to live on them by utilizing the wastes as sources of required carbon supplies.

Thus it is seen that the mold fungi all about us have a wide variety of habitat and nutrient requirements, most of which may be met by the materials present in sewage. Molds are scavengers, and what better place for scavengers than a sewage treatment plant where a wide variety of foods are available? It may even be possible that these waste scavengers may be turned into producers of important chemical and even food by-products, as research continues to develop information about their activities.

Application of Plastics in Chlorination Systems

MARVIN H. OWEN,

Senior Mechanical Engineer,
Dept. of Water and Power,
Los Angeles, California

AS IN MANY other fields where the reactions of corrosive fluids have presented maintenance and service problems in piping systems, the Los Angeles Department of Water and Power has turned to plastic piping and plastic piping components in its chlorination stations. To disinfect the water which supplies the 452.6 square miles of Los Angeles, there are 26 chlorination stations.

The original materials used in the Los Angeles chlorination system comprised hard rubber lined flanged cast iron fittings and valves; hard rubber pipe with screwed fittings; and Hastaloy "C" pipe, fittings and valves which were threaded. Hastaloy "C" is an alloy of nickel, chromium, molybdenum, tungsten and iron. Hard rubber lined pipe was used in 1½-inch pipe sizes and larger, and Hastaloy "C" and hard rubber were used in smaller sizes.

In seeking replacement materials for piping and piping components, several factors were considered: 1) Effect of the chlorine on the material; 2) service under pressure; 3) adaptability to field fitting and future modification of the system; and 4) cost.

In considering plastic materials, unplasticized normal impact polyvinyl chloride (PVC) by its history proved most acceptable for our intended service. We learned that PVC has been in use for more than 25 years in Europe. Since World War II it has been improved and has increased in use in this country. General properties of PVC which make it the most practical material are its high strength and good chemical and impact resistance. We have found that the use of these plastic materials has reduced our cost materially without any loss in service or efficiency.

Plastic Easy to Install

In our particular application we are currently using Kraloy PVC pipe and fittings and Chemtrol PVC ball valves. Kraloy plastic pipe and fittings are applicable because of their extreme ease of installation. The pipe is easily cut, fitted, heat formed, welded or threaded in the field with ordinary pipe cutters and threading tools. As the PVC pipe has a smooth interior surface and consequent even-flow characteristics, it shows no tendency to form obstructions. It is impervious to water, chlorine gas, chlorine solution in water, sunlight, soil and other elements. It can be purchased with either threaded or solvent welded type of fittings, either of which is easily field assembled. In our application we favored the threaded fittings because they are

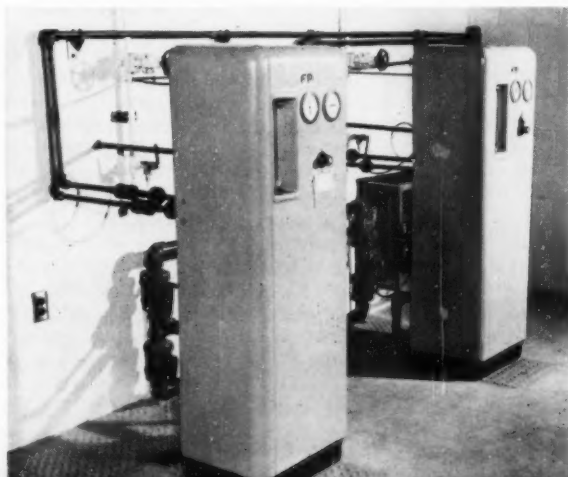
easier to remove for future changes. Prices are comparable with those of steel pipe.

Barring physical abuse, the plastic piping and components are expected to have a virtually unlimited service life. We are currently using Kraloy in 1½-inch lines carrying chlorine solutions from the chlorinators and ¾-inch lines carrying dry chlorine gas. This piping system has withstood test pressures of 250 psi.

It was found that Chemtrol normal impact PVC ball valves, in addition to having excellent corrosion and erosion resistance presented no problem of scale build-up on the ball. Their overall construction, which incorporates Teflon seals, insures against malfunction. Chemtrol valves have free-flow characteristics which eliminate turbulence in the lines. They operate with speed and their design is such that the handle position visibly indicates the valve position. By their structure, Chemtrol valves, which incorporate the union-type nut, are easily connected to plastic pipe without the use of additional flanges or unions.

In summarizing, we feel that our decision to use plastic piping, fittings and valves in our chlorination systems enables us to anticipate an unlimited service life in these materials with the knowledge that the systems are flexible for modification and the cost involved in this conversion represents an economy measure.

● **PLASTIC** valves and piping handle both chlorine solution and chlorine gas. One chlorinator is held ready for standby.



● **CLOSE-UP** of the injection pit at the Encino chlorination station shows 1½-in. and 2-in. Chemtrol plastic valves.

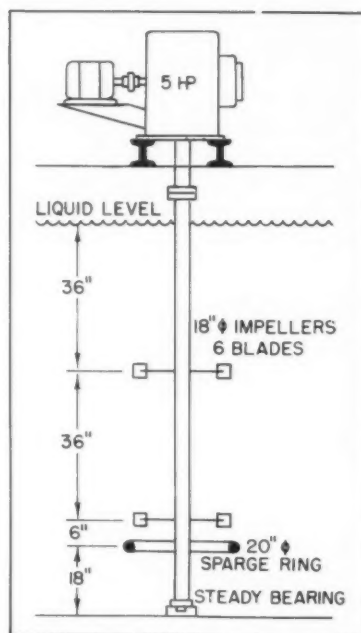


Recent Developments in the Aerobic

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This article is based on a paper presented before the National Council for Stream Improvement, The Greenbrier, White Sulphur Springs, West Virginia, August 7, 1958.

THE DISCOVERY of the activated sludge process in 1913 went far toward making biologic treatment of sewage economical. Thereafter, for 25 years, however, no significant process changes in either trickling filters or activated sludge plants were made, although there was considerable improvement in equipment and control. It was common practice to use primary plants where about 30 to 40 percent treatment was required. For greater treatment, secondary or biological methods were used and the plants were designed according to conventional criteria to give about 90 percent treatment. There was nothing in between. However, about 1940 a most significant new idea was introduced which has since seen fairly wide adoption although not, as yet, universal acceptance. This new concept holds that biological treatment can be adapted to give any degree of treatment desired.



● FIGURE 1. Pilot plant aeration unit uses sparger device with turbine mixer.

The development of the high-rate filter with recirculation gave impetus to this concept. Formulae were developed by the National Research Council¹ and by the Upper Mississippi River and Great Lakes Boards of Public Health Engineers² which indicate the interaction of loading and efficiency. Where something less than complete treatment

is required, it was shown that considerable cost savings could be effected.

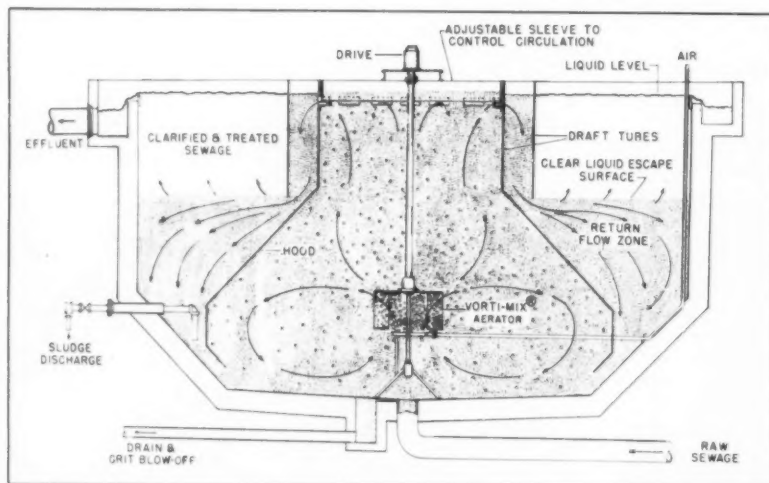
It has been well established that the degree of treatment in activated sludge is a function of the quantity of biological floc with which the waste is brought into contact. With a given size aeration tank, a greater degree of treatment is possible if more floc or activated sludge suspended solids are carried in the tank. The limiting factor has always been the ability of the unit to deliver the necessary oxygen to the microorganisms in the floc. Furthermore, the rate at which oxygen is required is generally highest during the period immediately following the mixing, at the head end of the aeration tank, of the floc with the waste. Almost all recent developments in activated sludge treatment are aimed at increasing oxygenation rates in order to permit high solids concentrations (more floc) in a given tank volume.

Two modifications developed more than twenty years ago represented an attempt to meet the high oxygen requirements at the inlet end of the aeration tank. "Tapered aeration" tried to do this by applying more air at the inlet end. "Step aeration" or "distributed loading" did this by distributing the waste among several points along the length of the aeration tank so that oxygen requirements would be more uniform along the length of the tank. Many of the units to be described later also accomplish this.

Air Diffusion

Recognizing the need to get more air into the mixed liquor, equipment manufacturers have developed many new and ingenious devices for diffusing air. Thin corrugated stainless steel tubes, with large openings and wrapped with Saran cord, were developed by the Chicago Pump Co. These have been popular because their light weight makes them readily removable for cleaning. Flexible bags and tubes have also been used which are self cleaning when the air pressure is released.

To avoid the problem of clogging, an impingement aerator was developed by Walker Process Co. in which the air released through large openings is broken up by a stream of water at high velocity. Cast spar-



● FIGURE 2. The principle of effecting air diffusion through a combination of mechanical mixing and injection of compressed air is employed in the Aero-Accelerator.

Courtesy Inflico Inc.

Biologic Treatment of Wastes by Aeration

gers have also been developed; these depend on high velocity through short-tube orifices to prevent clogging.

Selection among the various types has generally been based upon maintenance factors and cost, as all have about the same oxygenation efficiency. With any diffused air aeration, only about 10 percent of the oxygen added is absorbed; thus for each volume of oxygen absorbed 50 volumes of air must be compressed and distributed.

This relatively inefficient aeration has led to a resurgence of interest in mechanical assistance to diffusion aeration. The turbine mixer, an efficient tool of the chemical industry, added to an air sparger has led to an aeration unit such as shown in Figure 1. Air is supplied through large openings in the sparger ring and the fine bubbles desired for efficient oxygen transfer are created by the high-speed turbine mixer. This particular unit was used in a pilot plant investigation on pharmaceutical waste treatment conducted by Abbott Laboratories in North Chicago. No difficulties were reported with clogging or with solids collecting in the aeration tanks of the activated sludge plant. Efficiency of oxygen transfer with units of this type has been reported as high as 20 to 40 percent. However, these high efficiencies are attained at a considerable investment in electrical energy. The Abbott people reported that the pilot investigation looked quite promising in permitting high tank loadings, although they did report problems with foaming and with poor separation of the activated sludge in the final clarifier.

This type of aerator unit has been used by Infilco in the AeroAccelerator, shown in Figure 2, and by Dorr-Oliver in a conventional activated sludge process, shown in Figure 3. It appears to offer promise for construction cost savings, particularly in industrial waste treatment where wastes are strong and where space and capital saving are more important than somewhat higher operating costs.

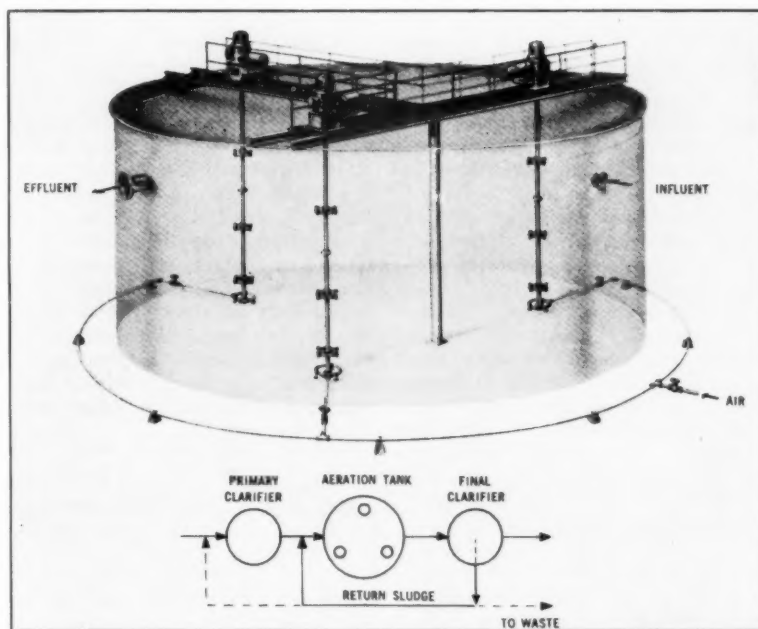
Schulze used a "Cavitator" manufactured by Yeomans for strong organic industrial wastes. Air is drawn down through a rotating hollow shaft and distributed at the ends of rotor arms on the shaft. A

somewhat similar device has been developed by Zieminski,⁷ in Maine, under sponsorship of the National Council for stream improvement. He uses high speed, rotating, perforated rings with air fed through the hollow drive shaft.

Activated Sludge Modifications

Modifications in the conventional activated sludge process are being made to suit particular needs: a lesser degree of treatment, a small package-type plant or economy in

aeration which gives 60-70 percent BOD removal. This is well suited to conditions where more than primary and less than conventional secondary treatment is necessary. New York City is a leading exponent of this type of high-rate treatment. With the short period of aeration the total oxygen requirements are less, but the rate of floc growth is rapid, and oxygen is required at a more rapid rate than in conventional processes. Thus, the process is sensitive and needs to



Courtesy Dorr-Oliver Inc.

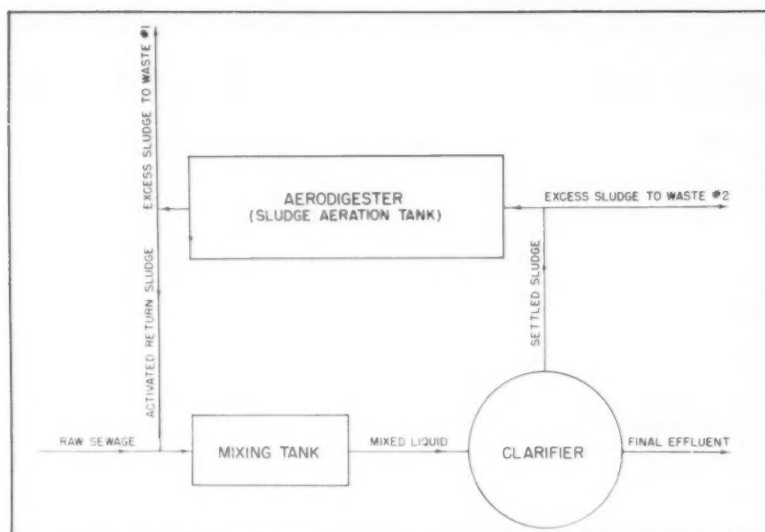
● FIGURE 3. Another example of effecting space saving by applying modified air diffusion techniques, in this case with the conventional activated sludge process.

plant construction or operation cost. A few of the more significant of these modifications will be discussed.

"High-rate activated sludge" or "modified activated sludge" uses a shortened period of aeration and a reduced quantity of solids in the aeration tank. Much less air is required than in conventional treatment but of course the degree of treatment is less. In more recent developments³, aeration periods as low as 30 minutes have been used where a low degree of treatment (50 percent BOD removal) was satisfactory, as compared with 2 hours for the more usual modified

be used with care. With strong, soluble wastes at elevated temperatures, it is difficult to supply the required oxygen, and complete breakdown of the process may result.

"Activated aeration," also a development for intermediate treatment in New York City, involves two parallel conventional activated sludge plants. Excess activated sludge from the first plant, which is a conventional plant, is added to the settled sewage influent to the second. The second plant does not incorporate any return of sludge. With an aeration period of about 3 hours in the second unit, about 75 per-



Courtesy Inflico Inc.

● FIGURE 4. The Biosorption Process involves concentrating the aeration phase in developing the activated return sludge which is recycled through the raw sewage.

cent reduction in BOD can be effected, with considerable saving in air. This process can offer considerable flexibility between aeration and conventional activated sludge so that treatment can be adjusted to meet changing requirements of the receiving waters.

The "Biosorption Process" developed by Ullrich⁴ at Austin, Texas, involves some departure from the conventional flow pattern (Figure 4). Raw sewage is mixed with activated sludge in an aerated mixing chamber for about 30 minutes. During this period much of the organic matter in the sewage is adsorbed by the activated sludge. After two hours sedimentation, the clarified waste is discharged as effluent and the sludge is then reaerated, with excess sludge being wasted. With high solids in the aeration tank the aeration period is about 2.5 hours based on average sewage flow. Based on actual throughput, the detention period is 5 to 8 hours. The settling period in the final clarifier ranges from 2 to 2.5 hours. The high solids can be handled without too much difficulty because the peak of the oxygen requirements is taken care of in the aerated mixing tank. For a high degree of treatment the tank capacity is somewhat less than for conventional plants, but air requirements are somewhat higher.

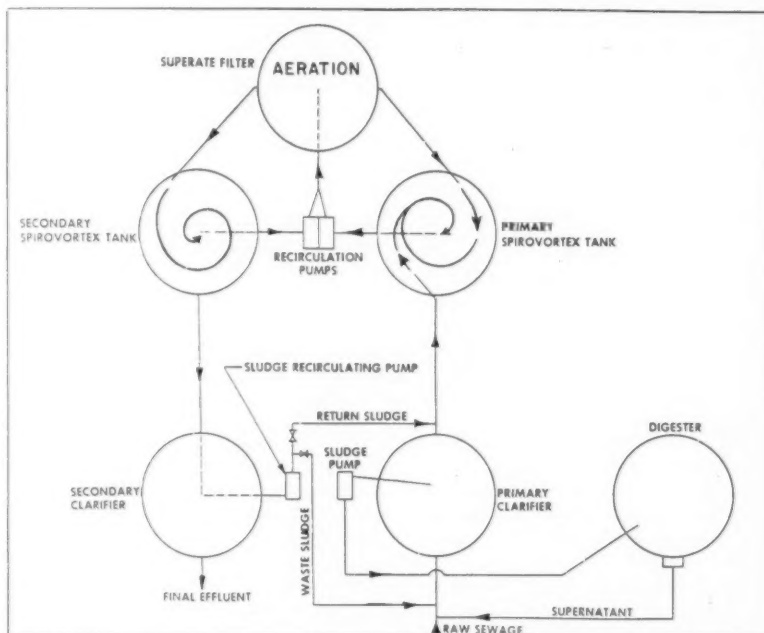
A similar approach has been studied by Eckenfelder and Weston⁵, who term the process "Contact Stabilization." They indicate that the amenability of organic substances to removal during initial contact is highly variable.

A further modification of the conventional flow diagram is the Dorr-Oliver "SpiroVortex System," developed in California and shown in Figure 5. Settled sewage is mixed with return sludge in a spiral-flow mixing or contact tank. Aeration is separate, in most instances in a 1-foot deep trickling filter unit operated at a recirculation ratio of 20-25 and a dosing rate of up to 450 mgad. A secondary contact tank follows and the mixed liquor goes

to a sedimentation tank for final clarification. The contact tanks are designed for a detention of about 6 hours based on sewage flow, giving a degree of treatment equal to that of conventional plants. Advantages of this flow sheet are claimed to be resistance to shock loads because of high recirculation rates, and simplicity of operation because of absence of air diffusion facilities. However, more units and more space are needed than for conventional plants, and recirculation costs are high. Whether aeration by a high rate of recirculation of waste over filters is more economical than diffused air or mechanical aeration remains to be demonstrated.

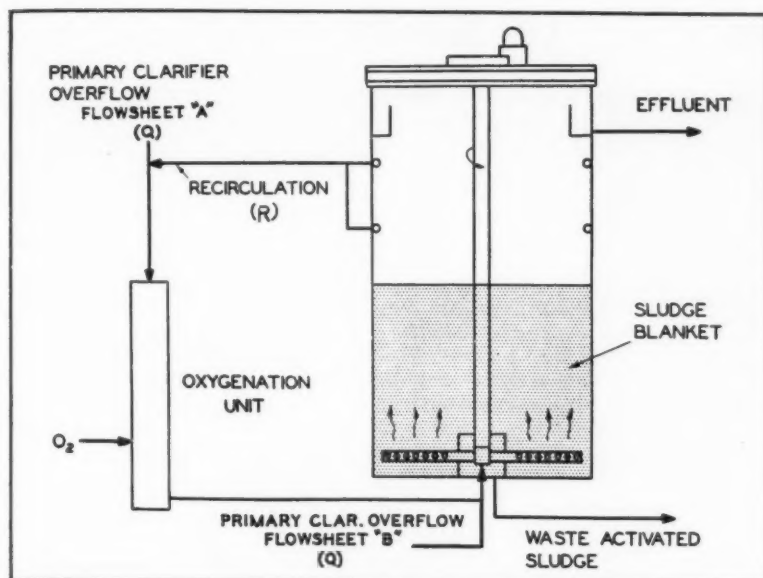
Septic Sludge Problem

One of the major difficulties with the activated sludge process is in the final settling tank where the sludge is separated from the liquor for return to the process. The microorganisms in the sludge require oxygen but none is available, and this situation is aggravated in the high-rate processes where there is less opportunity for stabilization in the aeration tanks. When the sludge is not removed rapidly enough, it tends to become septic and to place a heavier burden on the aeration facilities which in turn compounds the difficulties. This is accentuated in larger plants. New York City has attempted to mitigate the condition by sloping the floor of



Courtesy Dorr-Oliver Inc.

● FIGURE 5. In the SpiroVortex-Superate Filter Process, settled sewage is mixed with return sludge in a spiral-flow contact tank, with aeration applied by a filter.



● FIGURE 6. Pilot plant flow sheet of the Bio-Precipitation Process, in which sewage is oxygenated by oxygen gas and clarified in a sludge blanket contact unit.

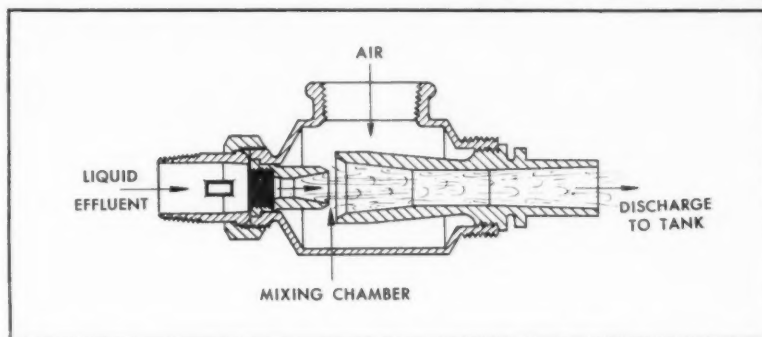
Courtesy Dorr-Oliver Inc.

rectangular final tanks in both directions towards a center sump thus reducing the travel time of the sludge. Another interesting development which would help solve this problem is the air-flotation separation of sludge in final tanks, which is now in the experimental stage.

"The Aero-Accelerator" developed by Infilco (Figure 2) avoids the problem of septic sludge by having aeration, contact and clarification all in one unit. Other manufacturers have developed similar small compact activated sludge plants, many with entirely mechanical aerators. The Chicago Pump Company "Aerator-Clarifier," the Yeomans "Aerifier," and the Eimco-Process "Oxidator" are well-known examples. Such units, as well as flow diagrams with high rates of recirculation in the aeration unit, have the effect of averaging out peaks of oxygen demand which appear when the floc is introduced into raw sewage in conventional activated sludge plants. With short contact periods for intermediate treatment in such units, however, the oxygen demand is very high per unit of BOD to be removed. With long periods of aeration and a high degree of treatment, the lower oxygen requirements of the endogenous phase of respiration, when active floc growth has ceased, reduce the oxygen requirements of the unit.

Use of Oxygen

A more considerable departure from the conventional flow diagram,



● FIGURE 7. A method of aeration involving air entrainment produced by recirculated effluent discharged through a combination of jets forming a Venturi section.

Courtesy Penberthy Manufacturing Co.

although operating on the same principles of aerobic biological treatment, is the "Bio-Precipitation" process using oxygen gas. The process involves the preoxygenation of the waste in a counter-current oxygenation unit followed by passage of the oxygenated waste up through a biological floc sludge blanket where contact and clarification take place simultaneously, as indicated in Figure 6. The oxygen and the nutrient for the microorganisms are carried in with the sewage as it passes through the blanket. If adequate oxygen cannot be provided by oxygenating the sewage flow alone, effluent is recirculated through the oxygenation unit. Using oxygen permits five-fold greater concentration of oxygen to be dissolved than when air is used. Among the chief advantages of the process are that high oxygenation efficiency can be achieved

in the preoxygenation unit. The vigorous agitation associated with such high efficiency does not affect the floc or its settleability, since the sludge is not itself oxygenated as is the case in all the other processes described. More important, oxygen and nutrient are available to all the microorganisms all the time. If DO is present in the effluent it is certain to be available for all the organisms. There is no period during which the organisms are deprived of oxygen, a common difficulty with all the other processes.

Budd & Lambeth⁶ describe the results of intensive pilot plant work on the process, using a 12-foot diameter unit. Oxygenation efficiency varied from 30 to 80 percent. Better oxygenation efficiency was obtained by oxygenating recirculated flow only. Energy costs for Bio-Precipitation, including oxygen production in tonnage quantities, and conventional activated sludge were about the same. Secondary

treatment area requirements were shown to be reduced 50 percent, and the volume requirements 30 percent as compared with conventional activated sludge treatment at the same treatment efficiency.

The process is flexible, and considerable operating cost savings can be effected if a lesser degree of treatment is desired. It appears to have its best application in the treatment of organic industrial wastes, where high oxygen requirements pose a problem for conventional aeration systems. The saving in space that it promises, and the simplicity and flexibility in operation also make it attractive.

Conclusion

The recent proliferation of aeration devices and flow diagrams recognizes the interest in economy in waste treatment. No one device, (Continued on page 161)

From Washington

to Maine . . .



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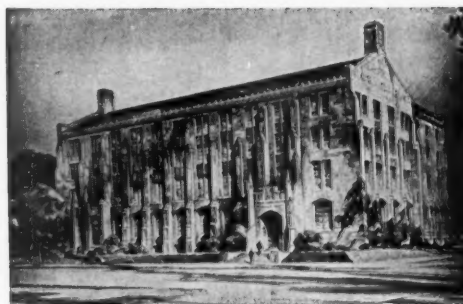


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News BULLETINS



AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Sponsor Professional Training Course in Municipal Public Works Administration

Chicago, Ill.—The Chicago Metropolitan Chapter is sponsoring a professional training course in Municipal Public Works Administration with the cooperation of the University of Chicago's Center for programs in Government Administration. The course is especially designed to acquaint individuals engaged in public works activities with recommended techniques and developments in administering municipal public works departments as well as for individuals who wish to prepare themselves for responsibilities in public works administration. The basic features of the course were developed by the American Public Works Association and the Institute for Training in Municipal Administration. The text used in the course is "Municipal Public Works Administration," fifth edition, 1957, published by the International City Managers Association, Chicago, Illinois.

The course has sessions on planning, finance, personnel management, engineering, equipment and supplies, streets and highways, street cleaning and snow removal, street traffic control, street lighting, water, sewerage, refuse, property management, inspectional services and public relations. Particular attention is being given to decision-making as the heart of the administrative process, communications and human relations problems by devoting several sessions to these aspects.

Thirteen lecturers are scheduled to review and supplement the infor-

mational material in the text. A special certificate of recognition will be presented to those of the 38 participants who elect to take the examinations that are prescribed but not required for the course.

Street Maintenance Committee Appointed

Chicago, Ill.—APWA President Wm. D. Hurst has announced the appointment of a Street Maintenance Committee as authorized by the Board of Directors "because of the growing interest expressed by the membership in this important activity." The Committee's first



Mr. Booth

assignment is to explore the most pressing informational needs in this field of public works and recommend a course of action for preparing a report to meet these needs.

Edward Booth, City Engineer, Bismarck, North Dakota, was appointed Chairman of the Committee. Members are Hunter Jones, Chief of Street Maintenance, Richmond, Virginia; Ben R. Paris, Director, Bureau of Street Maintenance, Los Angeles, California; C. M. Thelin, Director of Public Works, Fort Worth, Texas; and Randolph M. Martin, City Engineer, Vancouver, B. C.

1958 Revision of Sewer Specification is Available

Chicago, Ill.—The 1958 revision of the standard specification for public

works construction of sanitary sewers (J-1) was received from the printer recently. This 41-page standard is a complete revision of the sewer specification originally prepared and published in 1949. The 1958 version includes an introduction outlining its conditions of application, references and definitions. The specification is divided into 12 sections including Scope, Materials, Construction Units, Excavation, Pipe Embedment, Backfilling, Installation of Pipe, Manholes and Structures, Existing Sewers, Tests, Building Sewers, and Work in Cold Weather.

The Specification Committee on Sewers was responsible for the preparation of this document. H. A. Knudsen, Manager, (now retired) Sewage Disposal Division, East Bay Municipal Utility, Oakland, Calif., served as Chairman of the Committee. Members are: Dario Travaini, Superintendent of Water and Sewers, Phoenix, Arizona; Newell L. Nussbaumer, Nussbaumer, Clark & Velzy, Buffalo, N. Y.; A. L. Tholin, Administrative Engineer, Dept. of Public Works, Chicago, Ill.; Charles Abramovitz, Consulting Engineer, Ralph L. Woolpert Co., Dayton, Ohio; John Craig Oliver, Comr. of Works, Board of Administration, Vancouver, B. C., Canada; Peter Homack, Consulting Engineer, Scotch Plains, N. J.; E. F. Hughes, General Superintendent, Sewerage and Water Board of New Orleans, La.; and E. L. Filby, Consulting Engineer, Black & Veatch, Kansas City, Missouri.

Copies of the Specification may be obtained from APWA headquarters, 1313 East 60th St., Chicago 37, Ill. Price \$2.00. The usual APWA

OFFICERS: Wm. D. Hurst, Winnipeg, Manitoba, Canada, President; Jean L. Vincenz, San Diego, Calif., Vice President. REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. Immediate Past President, Sol Ellenson, Newport News, Va. Robert D. Bugher, Executive Director.

membership discounts apply (40% plus 10% additional discount on net price if payment accompanies order and no billing is required.)

APWA Represented at National Air Pollution Conference

Chicago, Ill.—By invitation of the Surgeon General of the Public Health Service, representatives of APWA participated in the National Conference on Air Pollution held in Washington, D. C., Nov. 18-20, 1958. The Conference was held to provide an opportunity for governmental officials, and representatives of indus-

try and voluntary organizations to meet together to assess their progress and to develop a coordinated plan for future action. Leo Weaver, Director of Research, APWA participated as a member of one of the special discussion groups "Control Methods and Procedures" and Wm. Xanten, Superintendent of Sanitation, Washington, D. C., was present as a discussion session participant.

Of interest to public works officials, particularly those with refuse incineration plants, was the Conference recognition and emphasis of the importance of local conditions such as meteorology and topography

in setting forth the significant nature of the various air pollutants in any given locale. Also, one of the conclusions and recommendations of the study session on "Control Methods and Procedures" set forth the need for simpler, accurate methods of measuring air pollutant discharges. (The APWA Research Foundation is currently endeavoring to serve to bring together the resources of a number of interested cities in the support of a proposed research project prepared through the cooperation of Armour Research Foundation to develop a simple and reliable method for measuring the particulate matter emitted from Municipal Incinerator Stacks.)

Eleven Chapters Report on Fall Meetings

Houston, Texas—The 12th annual Meeting of the Texas Public Works Association was held in Houston, Texas in connection with the Annual Meeting of the Texas Municipal League. Executive Director Robert Bugher was present at a special breakfast session which featured a business meeting and election of Officers for 1958-1959. Stepping up to the Presidency is M. M. Anderson, City Engineer, Abilene, Texas. W. A. Satterwhite, Jr., Chief Engineer, Public Works Department, Fort Worth was elected Vice-President and T. Spence Love, City Engineer, Southside Place, Houston, Texas, Treasurer. Elected Trustees were: O. J. Wagner, Director of Public Works, Palestine, Texas; and Clifton Bellamy, City Engineer, Big Springs, Texas.

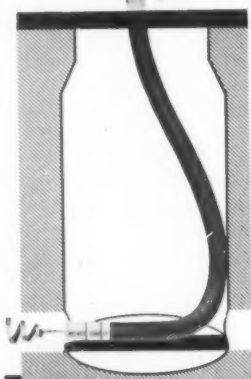
Redford, Mich.—Following lunch and an illustrated talk on "Engineering Application of Computers" by Ed Brender of Brender & Brender, Consulting Engineers of Wayne, the annual election of officers was held at the regular monthly meeting of the Michigan Chapter, October 16, 1958. Fred Cheek, City Engineer, St. Clair Shores, was elected President. Charles A. Johnson, City Engineer, Midland, 1st Vice-President; George Nampa, City Engineer, Royal Oak, 2nd Vice-President; Howard L. Lilley, City Engineer, Dearborn, 3rd Vice-President; and Dick Castle, City Engineer, Oak Park, Secretary-Treasurer.

New Orleans, La. — "Planning, Construction and Utilization of the Mississippi River—Gulf Outlet" was the theme of a talk by Lt. Col. Duane W. Ackerson, Deputy Dis-

28 Miles OF SEWER
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1958
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WORLD'S LARGEST MANUFACTURERS OF PIPE CLEANING TOOLS

trict Engineer, U. S. Corps of Engineers, presented at the November meeting of the New Orleans Chapter. Also featured were reports on the APWA Annual Congress and Equipment Show by W. L. Guardia, Division of Public Buildings and Carl Schneider, Consulting Engineer.

Portland, Me.—The second annual meeting of the Maine Chapter was held at the Eastland Hotel, Portland, Me., on November 6, 1958. The program was open to members of the Maine Municipal Association interested in Public Works. Lloyd K. Allen, City Manager, Rockland, Maine, moderated a panel on "District v. Municipal Water Department Operations." Serving as panel participants were: Julian W. Deshaies, Manager of Gardiner; Thomas M. Libby, Manager of Brunswick; Thomas P. Lund, Chairman, Board of Selectmen, Falmouth, and George J. Maher, Director of Public Works, Lewiston. At the business session which followed the panel discussion, Charles A. Haynes, City Manager, Rockland, was elected Chapter President for 1958-1959. Franklin W. Landers, Town Engineer, Brunswick, was elected Vice-President; and George J. Maher was re-elected Secretary-Treasurer. Elected Directors for two years were: Frank W. Bryant, Superintendent of Streets, Portland and William R. Adams, City Engineer, Lewiston, Me.

Waterloo, Iowa—A record attendance of 135 members and guests turned out for the 1958 annual conference of the Iowa Chapter. The conference program, arranged under the chairmanship of Carl Fagerlind, Street Commissioner of Waterloo, included an address of welcome by the Honorable Ed Jochumsen, Mayor of the host city, and a talk by L. A. Touchae, Executive Secretary of the Waterloo Chamber of Commerce, in which he stressed cooperation between public officials and their respective Chambers of Commerce as the most certain method of achieving community progress.

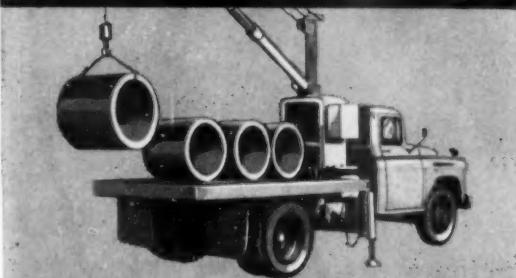
William D. McElwae, City Engineer of Muscatine, was elected President to replace C. J. Anderson, City Engineer of Marshalltown. Other new officers are L. H. Adams, Street Commissioner of Waverly, Vice President; and Jack Kilby, Assistant City Engineer, Dubuque, Secretary-Treasurer. M. A. Halvorsen, Commissioner of Streets and Public Improvements of Cedar Rap-

first...GET THE FACTS ABOUT MUNICIPAL TRUCK EQUIPMENT from **DAYBROOK**



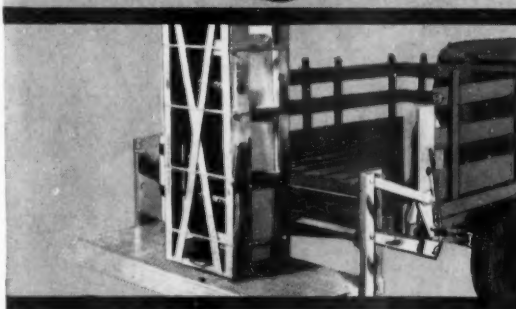
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ids, and Rex Matthews, Assistant Director of Public Works of Davenport, were elected to serve two-year terms on the Chapter's Executive Committee. Lloyd Dove, Director of Public Works of Ames and E. H. Finch are also on the Committee, serving the second year of their two-year terms of office.

Berkeley, Calif.—The Sixth Annual Meeting of the Northern California Chapter was held at Berkeley, Calif., November 14, at the Hotel Claremont. Luncheon at 12 was followed by an afternoon of technical sessions featuring presentations

on the California Freeway System. "Western Growing Pains" were discussed by George M. Dean, Vice President and General Manager, Pacific Telephone and Telegraph Co. (No. Calif. area). Mr. Dean's presentation was followed by three papers: "The California Freeway System Plans" by F. M. Reynolds, Principal Highway Engineer, and M. H. West, Supervising Highway Engineer of the California Highway Planning Survey; "Freeway Planning Methods" by Henry K. Evans, Manager, Western Division, Wilbur Smith and Associates; and "Coordinating Freeway Plans into the Local

Situation," by Victor Sauer, Director of Public Works, Contra Costa County.

Winnipeg, Canada—The annual meeting of the Manitoba Chapter was held on October 24, 1958, at the Marlborough Hotel, Winnipeg. Present as honored guests were APWA President Hurst and William Alldridge, former city engineer of Winnipeg, and a long-time member of the Association.

In his remarks, President Hurst urged the Manitoba Chapter to extend its field by planning to hold an extended meeting. He suggested that scouts be sent to Saskatchewan and Alberta in a drive for new members and chapters.

The President of the Chapter, Robert Strain, announced the results of the balloting for chapter officers for 1958-1959. Elected President was John Baker, Superintendent of Construction, Dept. of Engineering, Winnipeg; Vice-President, I. Simkin, Simkin's Construction Company, Ltd., Winnipeg; and Secretary, Treasurer, N. Diakiw, Superintendent of Construction and Maintenance, Dept. of Engineering, Winnipeg. Elected to the Executive Committee for two years were: S. R. Channing, Supt. of Shops, City Engineering Dept., Winnipeg; and H. W. Neilson, St. Boniface. Members of the Executive Committee with one year to serve are: Blake Moffat, Supervisor of Public Works, Selkirk; and Herbert Akehurst, City Engineer, Brandon.

Chicago, Ill.—Paul Screvane, Commissioner of Sanitation, New York City, addressed 150 members of the Chicago Metropolitan Chapter at a luncheon meeting Nov. 17, 1958. Commissioner Screvane discussed the Litter Prevention aspects of New York City's Clean City Program, in which he stressed the importance of Public Education, Enforcement, an Inter-Departmental Committee, and a strong interested citizens' advisory group.

Indianapolis, Ind.—The Indiana Chapter opened its fall meeting, by showing the film "Collector's Item", the story of the establishment of a combustible rubbish collection system in Los Angeles. Victor Wagner, Indiana State Board of Health, followed the film with a discussion of refuse collection and disposal practices in the state. The day's technical program also included presentations on the design of concrete pavements for city streets, modern practices in the maintenance of as-

These portable pumps prime at 30 feet lift!

These rugged new pumps prime and reprime at lifts up to 30 feet. Move easily because of light in weight aluminum construction.

Four models:

Midget	1½"	6,500 GPH	2.25 HP
Pelican	2"	8,500 GPH	2.75 HP
Hawk	2"	12,000 GPH	5.5 HP
Eagle	3"	18,000 GPH	6.8 HP



Pump at rest—Captured liquid retained for priming. Note no check valve.



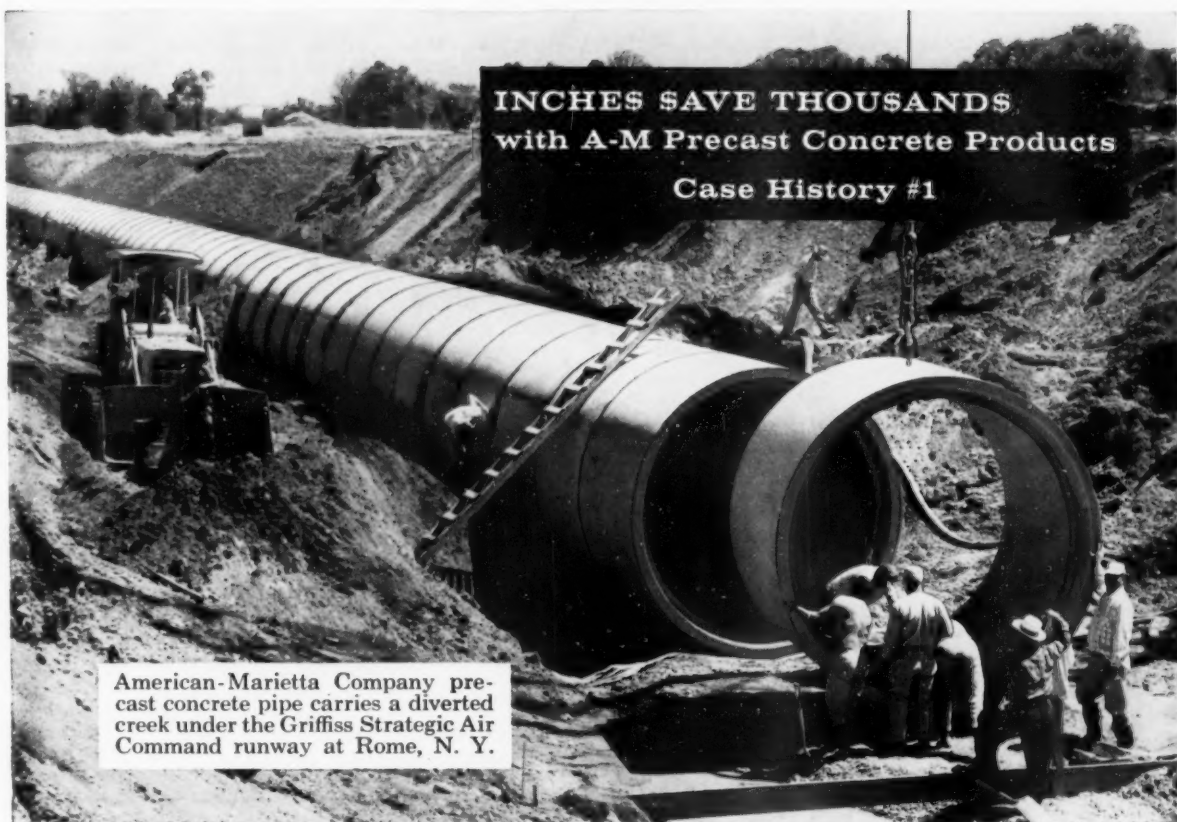
Priming action—Entrained air escapes at top to be discharged. Priming liquid returns to entrain more air.



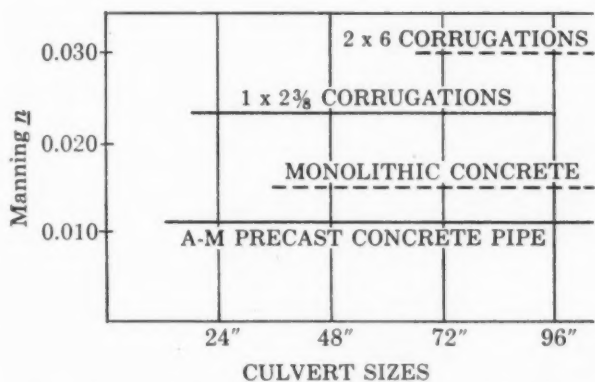
Pumping action—Straight-in suction voids entrance restrictions. Water enters direct to eye of impeller. Sediment is purged.



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- Precast concrete pipe will continue to serve year after year as a permanent structure virtually free of maintenance.
- Precast concrete pipe speeds and simplifies construction without fear of flotation, displacement or seepage.
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phalt pavements, recent developments in the design and construction of sewers and public works and capital improvement. Executive Director Robert Bugher was the luncheon speaker. At a business session just prior to the luncheon, Dan Richardson, Street Commissioner, South Bend, was elected President for 1958-1959. Don Gwinnup, City Engineer, Anderson, was elected Vice-President and Edward Green, City Engineer, Ft. Wayne, Secretary-Treasurer. Mayor W. D. Jefferson of Rochester and R. C. Lentz, Street Commissioner, Plymouth, were elected Directors for 2 years.

Roanoke, Va.—“Keep America Beautiful” and “Urban Redevelopment” featured the fall meeting of the Virginia-D.C.-Maryland Chapter held in Roanoke in conjunction with the annual meeting of the Virginia League of Municipalities. Moderator of the K.A.B. Panel was John T. Soltmann, Executive Vice-President of K.A.B., Inc. Sources of municipal litter were cited by Wm. A. Xanten, Superintendent of Sanitation, Washington, D. C.: “Law Enforcement and its Problems” by Robert Hopson, Director of Public Works, Richmond; “Educating the Public” by Joseph H. McCarthy,

Sanitary Engineer, Baltimore, Md. and “Action Through State Groups” by E. A. Hicks, K.A.B. Inc., Virginia.

Urban Redevelopment in Roanoke was discussed by C. Fred Mangus, Russel R. Henley and Thomas S. Fox; Chairman, Executive Director and Attorney, respectively, Roanoke Redevelopment and Housing Authority.

At the annual business session W. L. “Rockie” Rothgeb, Deputy Director of Public Works, Alexandria, was elected President for 1958-1959. Joseph H. McCarthy was elected Vice-President and Donald S. Frady, Director of Public Works, Falls Church, Secretary-Treasurer. Wm. A. Xanten and H. D. Bowling, City Engineer and Director of Public Works, Danville, were elected Directors for two years.

Philadelphia, Pa.—The Philadelphia Chapter recently met jointly with the Philadelphia Section of the ASCE at a dinner meeting in honor of Francis S. Friel. Mr. Friel, a member of APWA since 1926, was elected to the National Presidency of the ASCE for 1959 and assumed his post in October. The Philadelphia engineer has had an outstanding career and has been in charge of all engineering and management

of his firm for the past 27 years. He was designated “Engineer of the Year” in 1956 by the Engineering Societies of Philadelphia and received the medal award of the Philadelphia Chapter in 1948.

• • •

New York Plans Municipal Parking Garages

Plans have been prepared for construction of a municipal parking garage on Eighth Avenue between 53rd and 54th Streets, Manhattan, New York, estimated to cost \$1,-542,000. The plans call for a five-story reinforced concrete building of the sloping floor type which will accommodate 455 cars. The midtown garage is the second to be built by the New York Dept. of Traffic in a ten-year program to provide 40,000 off-street parking spaces at an estimated total cost of \$94,000,000. Also under consideration is a contract for plans providing for a 107-car parking field at an estimated \$50,000 for construction. The proposed plans include the innovation of the concealed or hidden coin type of parking meter, designed to require each user to insert a coin rather than use time left by the previous occupant of the parking space.

What it means to Buy

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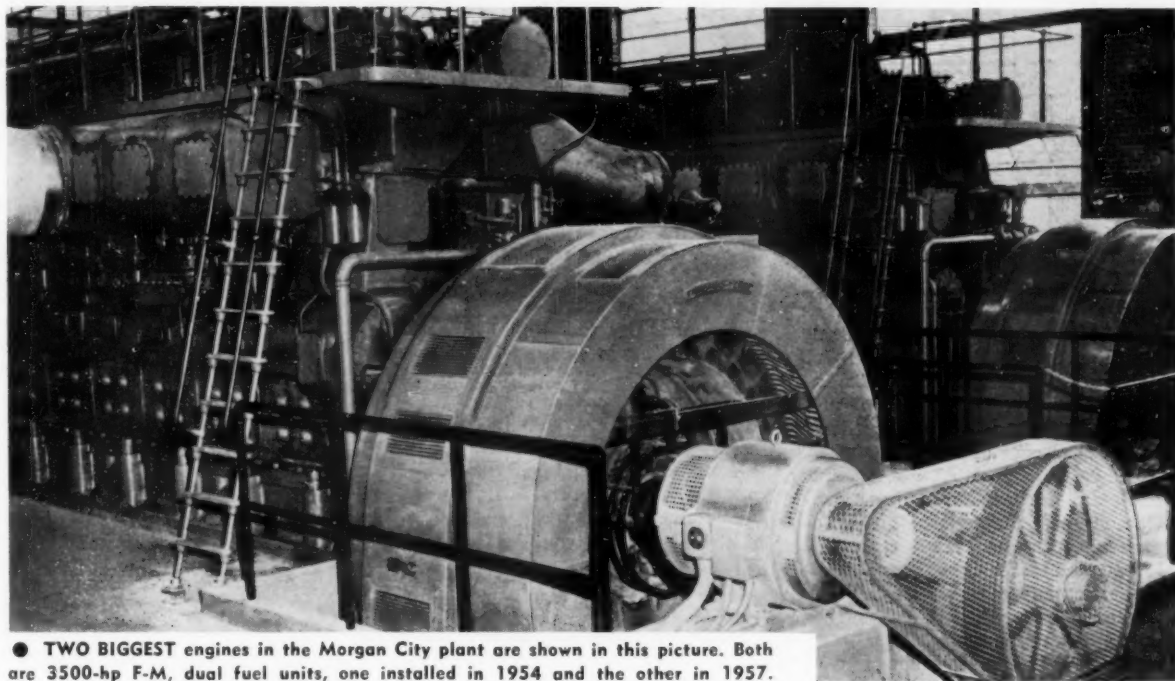
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It means you are making an investment for your community that will last a lifetime. You see, Miro-Flex signs are embossed not less than 0.100 of an inch which means that they not only are stronger, but are more legible than a flat surface sign because of the dimensional effect. Also, Miro-Flex signs are finished with the best baked-on enamel on zinc-coated Bond-erized steel to provide maximum durability without maintenance. Be sure to get your free copy of the Miro-Flex catalog on traffic control signs.



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Millions Come Faster TO THIS MUNICIPAL POWER PLANT



● TWO BIGGEST engines in the Morgan City plant are shown in this picture. Both are 3500-hp F-M, dual fuel units, one installed in 1954 and the other in 1957.

MILLIONS in profits are coming faster at the Morgan City, Louisiana, municipal power plant. After its modest beginnings in 1933, it took nearly 17 years for the first million dollars in net income. But output, efficiency and profits grew and the second million was bagged in less than five years. Now, with seven F-M dual-fuel engines totaling 14,690 hp, the plant will reach its third million some time in less than three years.

Morgan City is 29 miles inland from the Gulf of Mexico on the Atchafalaya River. Not only does this mean deep-water transportation to the seas but an inexhaustible supply of water for industry. Morgan City and smaller Berwick across the river are the gateway to tidelands oil and gas fields where more than a thousand wells have been drilled in the past 10 years.

Morgan City grew steadily from 6900 in 1940 to 9700 in 1950, then to an estimated 13,000 this year, with another 6,000 outside city limits but served by city utilities. Obviously, this entailed a substantial increase in the demand for electricity and the municipal power

plant expanded to meet the demand.

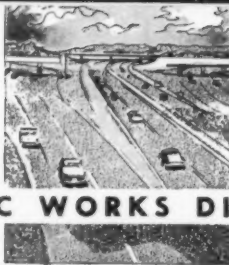
Until 1940, the entire load was carried by a pair of 630-hp Fairbanks-Morse diesels; then a 1050-hp F-M diesel was installed. At four-year intervals, a 1200-hp and then a 1600-hp F-M engine were added to the plant. In 1952, one of the old 630-hp units was replaced by an opposed-piston diesel rated at 1920 hp. The next step was a big one—the erection of a new building and the installation in 1954 of a 3500-hp F-M dual-fuel engine. Another 3500-hp unit was added in 1957. To bring the expansion program up to date, the second 630-hp unit was removed and another 1920-hp opposed-piston diesel was installed during 1958. This brings plant capacity to 14,690 hp. All 7 Fairbanks-Morse engines burn natural gas fuel with a small amount of diesel oil as a pilot fuel.

From 1934, first full year of operation, through 1950, the revenues of the department totaled \$2,267,240. The net earnings for the period were \$1,064,804. Production and profits continued to accelerate in the next seven years, with gross sales of the Water and Light Department

rising from \$396,836 in 1951 to \$835,403 in 1957. Similarly, net income rose from \$179,039 in 1951 to \$349,724 in 1957. The net for the years 1951 through 1955 was \$1,106,768. In the next two years, the city made \$838,026.

The plant has been completely self-supporting, financing all expansion from revenues. In addition, it has paid a substantial portion of the operating expenses of city government through transfers to the general fund. These contributions have been rising, going from \$87,000 in 1951 to \$150,130 in 1957. Total transfers for the 7 years amounted to \$768,449. The plant also provides each year free power for street lighting, sewage and drainage pumping, library, recreational centers and swimming pools, and plant personnel handle some maintenance work for city departments.

Basis for the success of the power plant has been sound operation of efficient and durable equipment. For the past 7 years, fuel costs have averaged 4.03 mills per kilowatt-hour. Maintenance expense has been low, averaging 0.44 mill per kw. hr. for the seven-year period.



PUBLIC WORKS DIGESTS

Prepared by

FRANK FORCE

Associate Editor

THE HIGHWAY AND AIRPORT DIGEST

Earthwork Office Methods With Small Electronic Computer

A small size electronic computer is making it possible for the Oklahoma state highway department to complete current earthwork computations in one-twelfth the time they used to take, with a degree of accuracy never before possible. In less than four hours, earthwork calculations can be performed by the Remington Rand Univac 120 for a mile of highway. This includes about three hours of operator time to punch and verify cards at the beginning of the operation. Other applications that the machine can do include checking contractors' bids for accuracy, and determining the low bidder, second lowest, etc. It is used to calculate the exact shape and area of each portion of an easement, telling how much of the easement is in each section and how much belongs to the present owner. Also handled electronically are such functions as cost analysis on all state equipment; maintenance costs on state roads; small structure computations, amount of steel or concrete necessary for a culvert; and calculating how much water runs off a given area with a given slope.

"Earthwork Office Methods With a Small Electronic Computer." By Ben W. Steele, Assistant Engineer

in charge of Electronic Computing Systems, Oklahoma State Highway Dept. *Roads and Streets*, November, 1958.

Airport Engineering— A Series of Project Studies

Consulting engineers are designing airports of the jet age. The problems are much the same as those faced by the airport designer of a decade ago—passengers, planes and parking—but the increase in the number of passengers and planes, and the demands of the high speed passenger jet only magnify them. Covered in these studies are the newest ideas in terminals and hangars, control towers and utilities, runway configuration and lighting, fueling systems and noise control—every major aspect of modern airport design.

"Airport Engineering—A Series of Project Studies." Consulting-Engineer, November, 1958.

Modesto's Off Street Parking Program

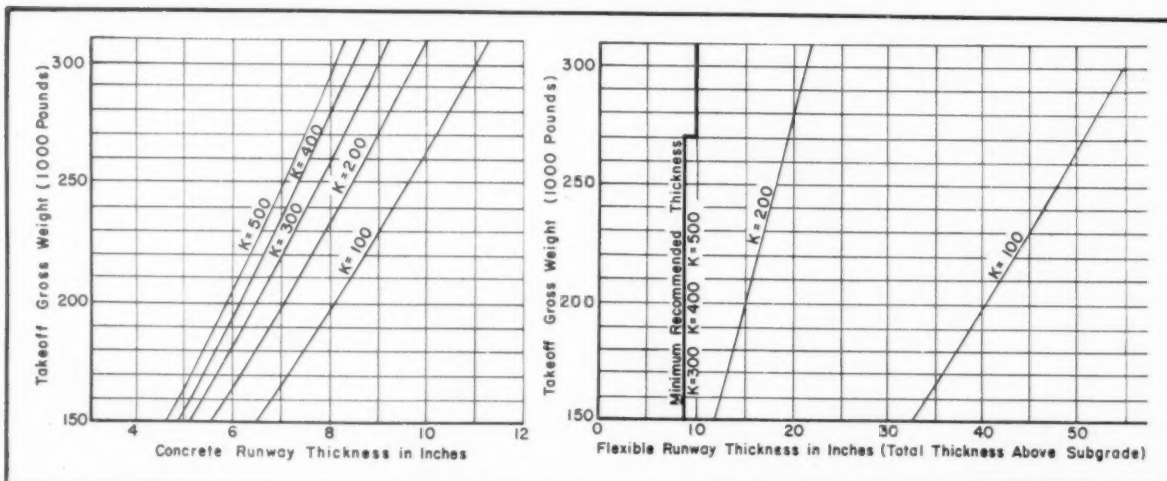
The City of Modesto, Calif., has 13 municipal off-street parking facilities and these consist of 12 lots and one two-level garage. The facilities provide a total of 882 spaces. City Council appointed three of its members to a committee to chart a course of action to

remedy the parking shortage. The course of action adopted included the following: 1) Rates for parking on municipal lots raised to 10c per hour; 2) the leasing of properties for municipal public parking be done only if proposed revenues will pay all expenses; and 3) that the City continue its parking program on a pay-as-you-go basis without recourse to bond issues. There are 9 parking areas held on leases as short as 60 days, and others for 10 years. The advantages of the leasing program are as follows: 1) All lots must be self-supporting, no pressures arise for "political" lots that are little used, or for special benefit; 2) with interest on revenue bonds running about 5½ per cent per year, by leasing, the value of the properties increases at less than 5½ percent per year; and 3) by leasing instead of buying, the City obtains greater flexibility.

"Modesto's Off Street Parking Program." By Douglas J. Carmody, Director of Parking and Traffic, Modesto, Calif. *Street Engineering*, December, 1958.

Granulated and Air-Cooled Slag for Road Construction

The extensive use of slag as a construction material for other than fill material began about 25 years ago by Allegheny County, Penna.



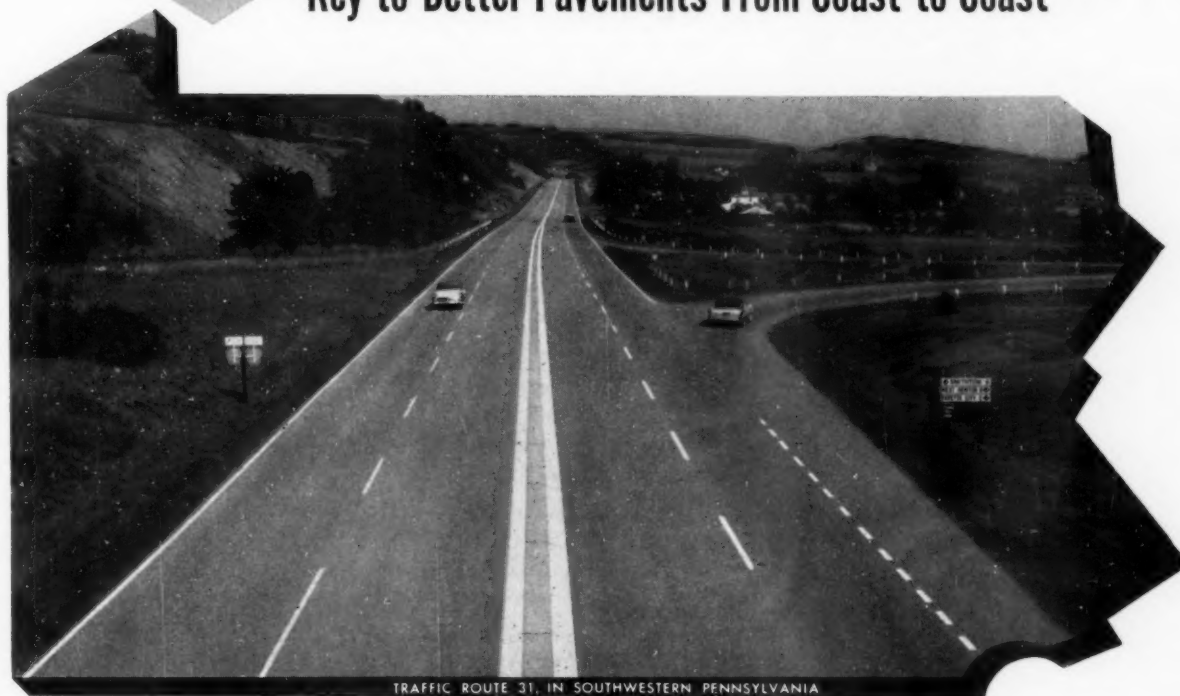
Courtesy Consulting Engineer

● THICKNESS for flexible and rigid runways; typical K value is 200 lb. per cu. in. for compacted earth subgrade.



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TRAFFIC ROUTE 31, IN SOUTHWESTERN PENNSYLVANIA

Across the nation, Chevron Asphalts and Bitumuls Emulsified Asphalts are being used extensively by roadbuilders to provide more and better roads for every dollar spent.

KEYSTONE STATE HIGHWAY CONTRACTOR BIDS PROVE ASPHALT DOLLARS GO FARTHER

The Federal Government's 90% payment of Interstate Highway costs has not reduced the need for economy nor the importance of getting more miles of durable pavements for our highway dollars.

Contractor bids and the awarded contractor prices for Interstate Traffic Route 31 of the Pennsylvania State Highway System prove that asphalt paving dollars go farther. TR 31, an important 43.17 mile main Interstate Highway which connects the Pennsylvania Turnpike and Interstate Route 40 was constructed of 21.74 miles of concrete and 21.43 miles of asphalt. Both types of pavement are on the same route and carry the same traffic. They were specifically designed for comparable service.

The total accepted bid price for the 21.43 miles of asphalt:



\$2,300,450.08. The total accepted bid price for the 21.74 miles of concrete: \$3,273,056.51.

Average cost per mile for concrete pavement \$150,554.57

Average cost per mile for asphalt pavement \$107,347.18

**AVERAGE PER MILE
SAVING WITH ASPHALT
PAVEMENT . . . \$ 43,207.39**

Congress, State Legislatures, and Highway Engineers are now concerned about funds to continue the construction of our important and badly needed Interstate System. The savings resulting from adequately designed, long-life, economical asphalt pavements for

the Interstate System will not only allow more rapid completion of the System, but in addition will benefit all of us by providing needed dollars for the constructing, widening, and resurfacing of important primary, urban, and farm-to-market roads.

Chevron Asphalt and Bitumuls products are available—coast to coast—for use by roadbuilders everywhere. They are backed by service facilities unmatched in the paving industry. A phone call to one of our more than fifty plants, refineries, terminals or offices will bring the information you need on any product or pavement design problem.



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All concrete pavement today is constructed of either slag or stone aggregate, with gravel aggregate concrete allowed for structures. Both Portland cement and bituminous pavements are usually constructed of slag coarse aggregate. After the roadway has been sub-graded and rolled, a 6-in. compacted thickness of granulated slag is placed and thoroughly wetted and rolled. No. 4 air-cooled slag is then placed on the granulated slag base over a 1-in. layer of slag screening acting as an inverted choke, to a compacted depth of 4 ins. This is rolled and

slag screenings applied in three operations, vibrated, rolled thoroughly, wetted and rolled until a slurry appears ahead of the roller. The second 4-in. layer is then similarly applied, resulting in an 8-in. waterbound macadam. After sweeping the macadam surface, a 2-in. hot asphaltic binder is applied and a 1½-in. hot asphaltic surface course is laid on the binder. In road widening, a 6-in. compacted depth of granulated slag is placed, wetted and rolled, followed by a 5-in. compacted layer of air-cooled slag waterbound macadam.

"Granulated and Air-Cooled Slag for Road Construction." By J. W. Carlson, Assistant Chief Engineer, Allegheny County, Pittsburgh, Pa. PUBLIC WORKS, December, 1958.

Traffic Operations On Freeways

The Federal Highway Act prohibits the development of automotive service facilities and commercial establishments, including restaurants, on the rights-of-way of Interstate Highways. Services for the motorist and his vehicle must be provided on the crossroads near the interchanges. State highway departments are considering these services in their design of the ramp termini at the crossroads. The local authorities, such as planning agencies, and zoning agencies, can do much to control the development on these crossroads so that an orderly plan emerges. A policy has been adopted for signing the Interstate highways. Policy guides have been prepared on the fencing of controlled access highways, and on locating police stations and maintenance yards. These two policies have been endorsed by the Executive Committee of AASHO and have been sent to the states for letter ballot. Signs will be justified only for important messages such as warnings and direction signs to interchanges and other justifiable turnouts. Messages will have to be simple and the letters used must be large. The AASHO policy on safety rest areas calls for areas separated from the through-traffic roadways, and with high-type entrances and exits including acceleration and deceleration lines. They may be designed for short-time picnic use, with water supply and toilet facilities where proper supervision and maintenance are assured.

"Traffic Operations On Freeways." By Paul F. Royster, Assistant to Federal Highway Administrator, Bureau of Public Roads. *Traffic Engineering*, November, 1958.

All-Weather Streets for the Price of Gravel

Several years ago Altus, Okla., undertook a program to pave some 27 miles of streets and all alleys by 1960. In 1958, about 140 blocks will be completed, with the same amount of work scheduled for 1959. The program will wind up with the paving of some 500 blocks of alleys. The city has a quarry plant under a lease-purchase agreement and also acquired a stockpile of some 100,000 tons of uncrushed material

How YOU can benefit from—



This year of 1959 is the Golden Anniversary of Wisconsin Engines. It heralds 50 years of continuous engine progress. Fifty years of engineering development and exclusive specialization in the design and manufacture of engines.

- Originally manufactured in a power range up to 200 hp., Wisconsin Engines helped to make automotive history as well as supplying dependable power for many industrial applications—service that called for the most advanced engineering.

- Heavy-duty design and construction and High Torque performance have been traditional features of all Wisconsin Engines. You get longer life from Wisconsin Engines and lowest cost maintenance.

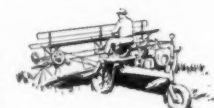
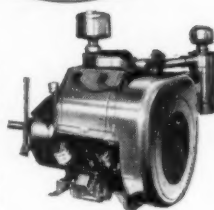
- Today the Wisconsin line comprises the most complete line of Heavy-Duty Air-Cooled Engines in the industry. They are supplied in 4-cycle single cylinder, 2-cylinder and V-type 4-cylinder models in a complete power range from 3 to 56 hp. There is a Wisconsin Engine of the right size and type to fit the job and the machine.

- Every Wisconsin Air-Cooled Engine is designed for heavy-duty service under all climatic conditions from low sub-zero to 140° F. You get the *Most Engine* for your money for MOST HP. HOURS of service.

- For 1959 Wisconsin has available a complete line of factory-built LPG Engines (including conversion kits for field installation on Wisconsin gasoline engines). In addition, we offer a new line of heavy-duty, quality-built Vertical Shaft Engines, from 3 to 7 hp.

- More than 2000 convenient Wisconsin Authorized Service Stations stand ready to provide expert servicing and factory-built parts for all Wisconsin Engines.

Constructive experience is a priceless asset. The benefits to the manufacturer, distributor and user of power equipment are many. You are best served in all respects when you specify "WISCONSIN ENGINES" . . . for better service, low-cost maintenance, trouble-free operation and long engine life. Write for engine bulletin S-237.



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CONSTRUCTION



RAILWAY



LAWN MAINTENANCE



WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

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New "3M Signal" Letters come to Wisconsin's land of the Braves!



"3M Signal" Letters feature exclusive stand-out mounting that minimizes dirt build-up . . . results in cleaner, brighter guide signs, less maintenance.

Bright, continuous white reflection of "3M Signal" Letters on this completely reflectorized sign points the way to safer, smoother traffic flow.

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in modern highway signing is proved in the state's use of completely reflectorized guide signs made with new "3M Signal" Letters that put motorists on the right road—safely—surely . . . day and night!

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for \$0.35 per ton. It costs about \$0.40 per ton to crush and haul the material, bringing the price for material on the job to about \$0.75 per ton. There are two types of pavements constructed. Both types consist of 6 ins. of pavement, but one type has concrete curb and gutters and the other does not have curb and gutters. Property owners desiring permanent paving must pay, in advance, \$1 per front foot to cover cost of curb and gutter. The city surfaces the streets at no extra cost. All work is done by municipal forces and with city-owned equipment. Cost of a 27-ft. street, 6 ins. in depth, comes to about \$0.51 per front foot, with \$1 per foot added for the curb and gutter. To maintain the streets, they are bladed with a grader, compacted and another coat of asphaltic seal added.

"All-Weather Streets for the Price of Gravel." By Wayne Posey, City Engineer, Altus, Okla. *The American City*, November, 1958.

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When their rented facilities were outgrown, J. Stephen Watkins, Consulting Engineers, decided to design an office building to meet their own needs. With an associate company, Watkins and Mills, Architects and Engineers, the consulting firm employs some 200 persons, about half of whom work in the home office. It was determined that the firms needed office space of roughly 17,000 sq. ft., consisting primarily of reception space, a dozen offices, and room for 70-odd drafting tables. The building was built on a property tract with a frontage of 228 ft. and an average depth of 236 ft. Better working conditions provided in the new building are achieved through convenient layout, good traffic circulation, air conditioning and many other features. Foundation walls are concrete, outside walls are brick veneer on concrete block and interior bearing walls are concrete block, plastered and painted. The roof is a flat, built-up type with cut stone coping. An 80 by 38-ft. basement houses the mechanical equipment, a fire-proof dead file vault, several storage rooms and a 12-table drafting room. The partial second floor, 80 by 45 ft., over the front portion of the building, will serve for possible or inevitable future expansion of the firms while providing presently-profitable rental space.

"Functional Office Facilities for an Engineering Firm." By John



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City _____ State _____

R. Parker, J. Stephen Watkins, Consulting Engineers, Lexington, Ky. **PUBLIC WORKS**, December, 1958.

Maintenance of County Roads

The present road mileage of 216 miles in Orange County, N. Y., is made up of 12 miles of concrete; 29 miles of bituminous concrete on cement concrete base; 17 miles of bituminous concrete on bituminous macadam base; 44 miles of penetration macadam; 107 miles of road mix macadam; and 7 miles of bituminous double surface treatment. Widths of pavement vary from 18 to 24 ft. Annual costs of maintenance operations on County roads are as follows: Patching, \$25,000; cleaning culverts, ditches and repairing shoulders, \$30,000; mowing, cutting weeds and brush and removing trees, \$35,000; repair and replacing guide posts, \$5,000; and cleaning up rubbish and debris scattered by the traveling public along the roads, \$3,000. The cutting of shoulders and ditches is considered to be the most vital phase of maintenance in prolonging the life of the pavement. To prevent the development of surface cracks and

resulting porous condition, bituminous penetration and road mix pavements normally require surface treating once every three years. Chemical control of weeds and brush has been carried on for the past two years by County personnel and equipment. Approximately \$10,000 is spent each year for repair and maintenance of bridges.

"Maintenance of County Roads." By Earl Dickerson, Orange County Supt., Goshen, N. Y. **PUBLIC WORKS**, December, 1958.

Other Articles

"Signs for Safety." In Montgomery, Ala., the Traffic Engineering Div. is made up of the Sign Shop, Street Marking and the Engineering Section. By Charles Alexander, Assistant Traffic Engineer, Montgomery, Ala. **PUBLIC WORKS**, December, 1958.

"Minimizing Traffic Interference Caused by Utility Work in Streets." Ordinances on street openings in San Francisco are covered. **PUBLIC WORKS**, December, 1958.

"Design of Ross Spur Motorway Bridges in Gloucestershire." There is a full use of prefabricated units on this project. **Highways and Bridges and Engineering Works**, October 22, 1958.

"Street Lighting and Safety." Accidents, road surfaces and speeds are covered in this research program. By

A. W. Christie and R. L. Moore. **Contractors Record and Municipal Engineering**, October, 22, 1958.

"New Haven Scores a Hit with Snow Removal Program." First storm tie-up brings change from ad-libbing to well-organized script. By David M. Beers, Assistant Director of Administration, New Haven, Conn. **The American City**, November, 1958.

"Regina Stabilizes Streets with Asphalt and Saves." By K. R. Pattison, City Engineer, Regina, Saskatchewan, Canada. **The American City**, November, 1958.

"The Performance and Efficiency of Standard Compacting Equipment." By David Townsend, Associate Professor of Civil Engineering, Queen's University, Kingston, Ont. **Roads and Engineering Construction**, October, 1958.

"Electronic Computers Used in Design of Two Double-Deck Tied-Arch Bridges." By Jerry C. L. Chang, Principal Assistant Engineer, Design, Richardson, Gordon and Associates, Pittsburgh, Pa. **Civil Engineering**, November, 1958.

"West Virginia Launches Crash Engineering Program." Aerial photography, tellurometers, helicopters and computers are pressed into service to accomplish in months what used to require years. **Roads and Streets**, November, 1958.

"Salt Stabilization is County Road Solution." By S. A. Selway, **Modern Highways**, November, 1958.



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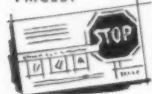
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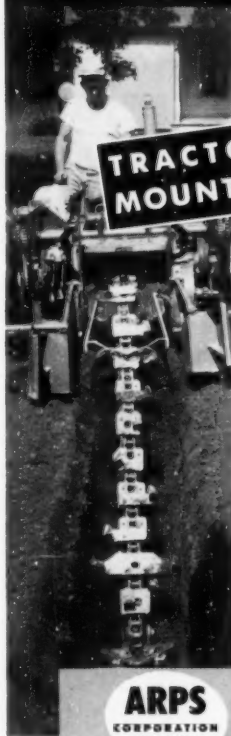
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TIMBER WHARVES REPLACED WITH STEEL-CONCRETE CONSTRUCTION BY PORT OF NEW ORLEANS

W. J. HOGG,

Director of Engineering,

Port of New Orleans

THE BOARD of Commissioners of the Port of New Orleans administers over 7.8 miles of publicly owned wharves and other related facilities as well as the 5.5 mile long Inner-Harbor-Navigation Canal connecting the Mississippi River with Lake Pontchartrain. Sites along the Canal are leased to private industries. A continuing 10-year construction program was adopted in 1955, calling for the modernization of virtually all existing timber wharves on the river front with steel and concrete construction; also building of new facilities both on the river and the Inner-Harbor-Navigation Canal. About 30 million dollars has already been spent on modernization and new facilities since World War II and another 70 million dollars will be invested by 1967.

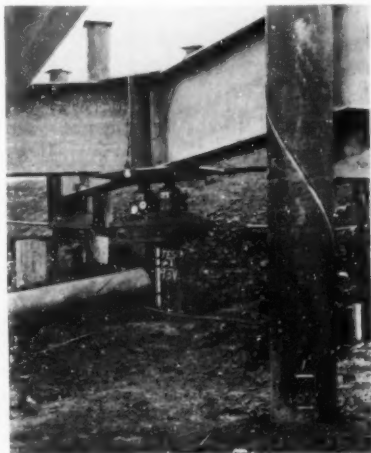
Along the Mississippi River, because of the heavy silt burden carried by the currents, only wharves constructed parallel to the natural river bank are feasible. While this "quay type" wharf has the disadvantage of affording a minimum of berthing space in relation to available shore lengths, it is preferred by ship operators for ready access and quick berthing.

The initial west bank public wharf will consist of a steel pile and concrete deck structure 1150 ft. in length and 230 ft. in width, with a steel frame transit shed 1000 ft. in length by 160 ft. in width, a shipside apron 40 ft. wide and an inshore apron 30 ft. in width. The shipside apron will have two railroad tracks level with the deck. The inshore apron will be served by two adjacent railroad tracks depressed to place car floors level with the apron deck. It will be located between McDonogh Ave. and Perry St. in the City of Gretna, Louisiana, and will be named the Perry St. wharf.



● FOREST of piles will support a new wharf. Two rigs placed approximately 2800 of these spiral welded pipe piles.

Design features of the Perry St. wharf vary considerably from those typical of the Board's structural steel and concrete wharf structures built in the period of 1924 to 1955. This previous design consisted of concreted footings and pedestals supported on timber piles cut off slightly above the low water stage of



● DESIGN load of each pile is 50 tons. During test pile settled only 3/8-in. under an applied load of 140 tons.

the river; a structural steel frame of columns and beams erected on the concrete pedestals; and a concrete deck cast on the steel beams. Construction of the concrete footings slightly above the low-water stage was subject to considerable delay owing to periods of high river stages—sometimes extending over a period of several months. To eliminate such delays in an extensive construction program, the new wharf structures will consist only of steel piles extending above high water stages to deck level, and a concrete deck cast on the steel piles.

Welded Pipe Piles

Armco spiral welded pipe piles were selected for the initial construction. All piles will be filled with concrete after driving. The only reinforcing is at the top, which ties the piles to the reinforced concrete deck slab. Corrosion protection in the low water level is accomplished by a 3-in. thick reinforced concrete encasement 6 ft. long, the bottom of which is 3 ft. below mean low water. Two coats of red lead and two coats of aluminum paint will be applied above the concrete encasement. The Board purchased the piles (before the construction contract was let) to assure availability of the piles when required by the construction contractor. They vary from 12¾ to 18 in. outside diameter. Because of the favorable test load results obtained on the 14-in. pile, a loading of 50 tons was selected in designing. This was less than 50 percent of the tested soil bearing capacity of the piles. The larger diameters are used only where slenderness ratios in deep water areas require them.

Due to the increased carrying capacity and stacking range of modern handling equipment, the deck loading of the recently completed First St. wharf and also that of the new Perry St. wharf was increased to 750 lbs. per sq. ft. minimum, with truck axle load capacity equivalent to H-20-44 highway loading. This was in contrast to the 350 lbs. for

the structural steel and concrete construction used from 1924 to 1955, and the 250-lb. loading for timber wharves constructed before 1924.

The completed wharf structure and railroad trestle approach to the shipside apron will have a total of 2818 piles of lengths varying from 100 to 125 feet. Piling cylinders were delivered to the site in 45 and 60-ft. lengths. The 60-ft. lengths are of 0.188-in. wall thickness and have flat steel closure plates welded to one end. These lengths are being used for the lower sections of the piles. The 45-ft. lengths have 0.25-in. wall thickness and are welded to the 60-ft. lengths before driving to form the upper section of the pile. Where piles longer than 105-ft. are required additional lengths of 0.25-in. wall thickness are welded to the top of the piles after driving the 105-ft. length.

Piles were driven with a Vulcan No. 1 hammer. Because of unstable soil in the river banks, and the probability of soil displacement from driving causing riverward movements in the piles after the driving, the piles were driven progressively from shoreside into the river. The pile drivers traveled on the driven piles, and later on barges.

Another project in the \$70-million improvement program for 1957 to 1967, at New Orleans is the new Nashville Ave. wharf. It will be of construction similar to the Perry St. wharf but approximately double in size.

The wharves were designed by the Engineering Department of the Port of New Orleans, with the author as director, and the late Marcel Farsaud who was engineering consultant of the Port. Supervision of the construction is handled under the direction of C. L. Jones, assistant director of engineering. A. R. Boelte, designing engineer, was in charge of design. Boh Brothers Construction Co. of New Orleans is the contractor on the Perry St. wharf. Ralph Junius is the piling superintendent.

Cost of Meter Testing

It cost Detroit, Mich., 23½ cents each to test ⅝-inch water meters during the fiscal year 1957, 26,941 being tested for flows from full to 1/32-inch. For ⅝-inch meters, it cost \$19.69, on the average, for installation; average cost of repairing frost damaged ⅝-inch meters was \$5.76, while hot-water damaged meters averaged \$6.93; repairing "wear and tear" cost \$5.98 for the same size meter.



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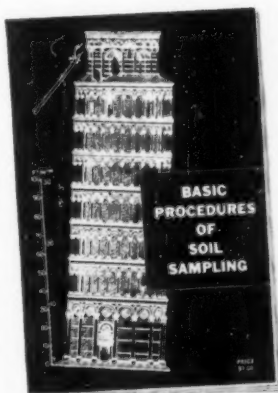
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Prepared by

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Associate Professor and Head,

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Columbia University School of Public Health

THE SEWERAGE AND REFUSE DIGEST

Radioactivity And Digestion

Part I of this two-part paper, containing the general description of the investigation, the methods used, and the results of P^{32} experimentation, appeared in the September, 1958, issue. The results of the I^{131} phase of the study are reported here. On the basis of these investigations on the effects of radioactive wastes containing I^{131} concentrations up to 100 mc/l the following conclusions were made: 1) The rate of gas production from similarly prepared seeded mixtures was not significantly altered. 2) The ultimate gas production, volatile acids concentration, reduction of volatile matter and pH, were not significantly affected. 3) The redox potential obtained showed no significant difference. 4) The gas quality was not affected. 5) There appears to be no significant change in the uptake of I^{131} by the solid phase.

"Effects of Radioactive Materials on Anaerobic Digestion." II Radioiodine. By W. N. Grune, D. D. Bartholemew and C. I. Hudson, Jr. *Sewage & Industrial Wastes*, November, 1958.

Underground Photography

This article explains the methods for observing through photography the exact location and status of breaks or failures or the overall condition of sewer or water pipes that are buried underground. The condition of deep wells may be observed by this technique to aid in their maintenance and repair. In the application of photography to sewer maintenance, a Laval camera is mounted horizontally, usually on wheels. The camera on sled or wheels is placed in the sewer at a manhole and pulled up to the next manhole by a cable connected to a winch. The electrically-operated camera may contain enough film to photograph $\frac{3}{4}$ of a mile when taking pictures every 5 feet. The camera can travel 10 to 20 ft. per minute and can take pictures every 15 seconds. Three of the common defects other than collapse which can be

easily detected by this type of survey are: 1) the infiltration of ground water, when the ground water table is above the sewer pipe; 2) the intrusion of roots and; 3) the accumulation of grease. The advantages for this type of operation are many; one of the most important being that no man need risk his life or limb in making sewer inspections. Other advantages are the accurate detection of structural failure and the inspection of small sewers which a person could not enter and where expensive digging would be the only possible alternative to photography. The article also explains the use of photography in the inspection of the three common types of well failures, all of which show up very well with the Laval camera. These three types of well failures are: 1) axial compression failures; 2) parted casing failures; and 3) casing collapse failure. For repairing all types of casing breaks and distortion, a companion tool to the well camera is the Laval electro-hydraulic swage which can quickly and safely straighten out compression wrinkles, breaks and ovals; and also push back into place torn sections of casing.

"Underground Photographic Surveys." By Charles H. Sortor. *Water and Sewage Works*, November, 1958.

Dissolved Oxygen Determination

The author suggests a new modification to the Winkler Method of determining dissolved oxygen by substituting sulfamic acid for concentrated sulfuric acid. Every laboratory worker knows the precautions necessary to prevent damage to equipment, clothes and to himself in handling sulfuric acid. Sulfamic acid (NH_2SO_3H) is a readily available, inexpensive, relatively non-hazardous white crystalline solid acid. It is non-volatile and non-hygroscopic. The sulfamic acid is added in solid form by means of a stainless steel or plastic measuring spoon of the $\frac{1}{2}$ -teaspoon size. This spoon contains approximately 4 grams when filled level, enough to neutralize 2 ml of the alkaline-iodide reagent and acidify the sam-

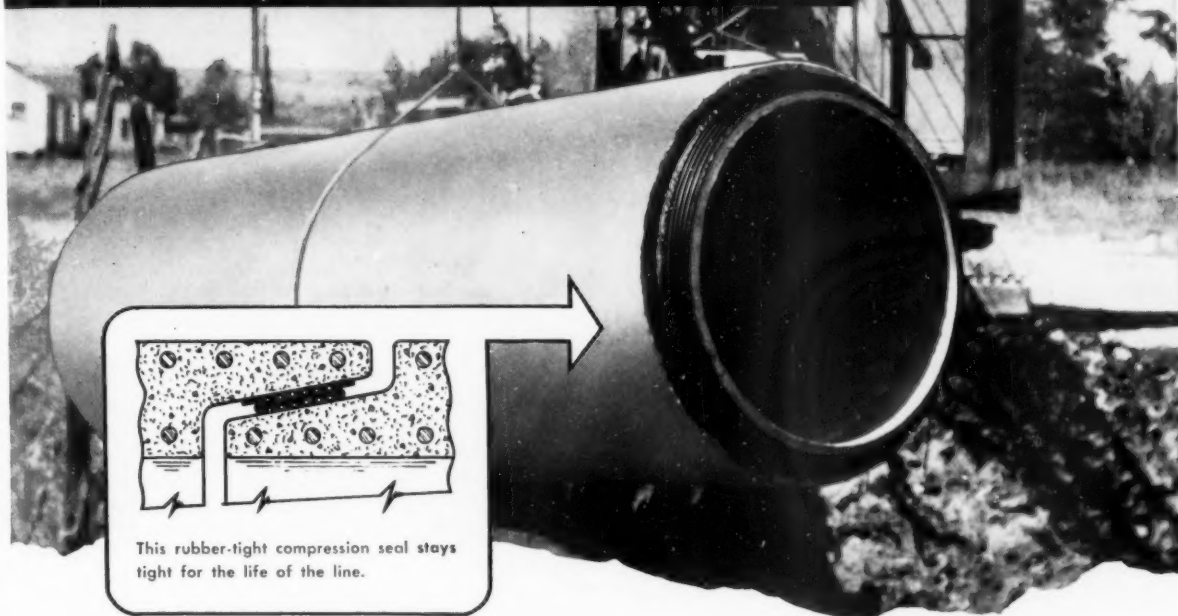
ple. The sample is vigorously shaken and titrated normally. It is not necessary to add sodium oxide to the alkaline-iodide reagent as the sulfamic acid prevents any significant interference from the presence of nitrite. The author also contributes two suggestions which may be worth while in setting up a field kit for dissolved oxygen analyses. The first is the use of a solid soluble starch known as Niagara Soluble Starch instead of the conventional starch indicator solution. This starch is soluble in cold water, stable and quite inexpensive. A small amount of the solid is added to the sample being titrated before the endpoint is reached. The second suggestion is that an inexpensive but effective substitute bottle has been used for both the dissolved oxygen and BOD analyses. A conventional 24 or 28-mm screw cap, round or square form, bottle of 8 ounces capacity (approximately 250 ml) is used in conjunction with a 24 or 28-mm Polyseal plastic cap. The cap is made of a hard plastic with a conical polyethylene inner seal. Bottles and caps may be obtained separately and are very inexpensive. When used for the BOD determination no water seal is necessary.

"Dissolved Oxygen Determination." By Isodore Nusbaum. *Water and Sewage Works*, November, 1958.

Design Criteria and Cost

This report includes a study of sanitary engineering design practice and construction costs and a preliminary review of provisions made for the financing of operation and maintenance for 20 small secondary sewage treatment plants being constructed in the States of Wisconsin, Illinois, Indiana, Michigan, and Ohio. Four plants from each of these five States were selected at random for this study. The influence of the "Ten State Standards" on sewage treatment plant design in the North Central States is readily apparent. There was very little evidence of preliminary investigation to determine basic design data. Primary reliance was placed upon arbitrary per capita

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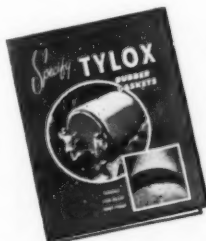
to cut job costs by speeding pipe-laying. They knew, too, that once under ground and under compression, acid-resistant Tylox would outlast the pipe itself.

* **PROJECT:** City of Billings, Montana: Interceptor sewers.

ENGINEERS: Sam Ward, City Engineer, and Kel Bainum, Assistant City Engineer, Billings, Montana

CONTRACTORS: C. B. Lauch, General Contractor, and Lloyd B. Lockrem, Construction Contractor, Billings, Montana

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flows and BOD loads in common use throughout the country. The design of influent devices for rectangular sedimentation tanks continues to be an empirical exercise for the engineer but the discussion of three "unusual" designs gives recognition to the fact that some engineers are dissatisfied with the usual influent port designs. There are also indications of a need for better guide lines for the design of filter structures. Greater attention should be given to the problem of planning for the financing of operation and maintenance of sewage treatment plants. It is also shown that good cost data

offering close correlation with types and sizes of projects can be developed if sufficient detailed information is available.

"Design Practices and Costs for Small Secondary Sewage Treatment Plants in the Upper Midwest." By D. H. Howells and D. P. Dubois. *Sewage & Industrial Wastes*, November, 1958.

Citizens Promote Sewage Project

A citizens committee of business and civic leaders in Atlanta and Fulton County, Ga. studied needed

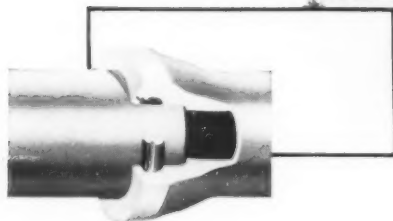
public works improvements, recommended spending limits and presented the issues squarely to the voters, resulting in overwhelming approval of a joint city-county bond issue. The recommendations of all the sub-committees totaled \$99,500,000, but the committee as a whole decided to limit the city issue to \$35,000,000, the school issue to \$16,930,000, and county bonds to \$35,000,000. It is interesting to note that the sub-committee recommended the full \$11,337,500 for sewers which had been recommended in the report submitted by the consulting engineers engaged by the city to study the sanitary sewer system. The subcommittee also added \$500,000 for construction of open storm water channels. The committee's final recommendations for city sewage projects totaled \$11,000,000. A county sewer program costing \$3,425,000 was also recommended as part of a broad public works program. The board of aldermen unanimously approved the recommendations of the Citizens Advisory Committee and passed an ordinance calling for an election. The Fulton County Commission did likewise. Good publicity was given the sewage program by newspapers. City and county officials, members of the Citizens Advisory Committee and other civic leaders appeared almost every day before community groups of one kind or another explaining the bond program. The city and county sewer bond issues were overwhelmingly approved at the election. Some of the projects are in progress while others are in the planning stage.

"Civic Leaders Promote Sewage Project." By M. B. Nixon. *Wastes Engineering*, November, 1958.

Sanitary Engineering Research

PUBLIC WORKS once again emphasizes the importance of the individual, the man with an idea and the curiosity to want to explore uncharted areas in the field of sanitary engineering. This magazine has devoted considerable space to report on these research activities in the December issue. This reviewer has decided to report on the group of articles, as a whole, instead of any single article. The lead-off article is a discussion of the "Role of the Federal Government in Supporting Research," with particular emphasis on its relation to public works. To encourage basic research, the National Science Foundation was created in 1950 as an independent agency of the Federal government.

Use MJ Fittings with **MCWANE** **TYTON JOINT** cast iron pipe



In construction of a pipe line with McWane Tyton* Joint cast iron pipe, most customers use all-bell Mechanical Joint fittings. If preferred, plain all-bell fittings may be used with lead joints. McWane Tyton Joint plugs are available for closing a dead-end, either for testing or future extension. Photo above shows an MJ Tee being set into a Tyton Joint pipe line.

McWane Tyton Joint Super DeLavaud cast iron pipe is furnished in accordance with ASA, AWWA, or Federal specifications. The weight of Tyton Joint pipe is the same as the weight of bell and plain-end pipe for the same specification.

Tyton Joint pipe for water is furnished tar coated, cement-lined or Enamelled. Tyton compound rubber gaskets are furnished with each order, and Tyton fork tool or jack are either loaned or sold with each pipe order, if desired. IMMEDIATE SHIPMENT all sizes. Write for illustrated Tyton pamphlet.

(*Patented and ®).

(2" and 2 1/4" Through 12" For Water Mains)

McWANE CAST IRON PIPE COMPANY
GENERAL OFFICES & FOUNDRIES, BIRMINGHAM, ALA.

Sales Offices: Dallas Chicago Kansas City New York Birmingham



This Pocatello, Idaho, storm sewer in good condition after 45 years

In 1914, Pocatello, Idaho, installed this 36-inch-diameter Armco Corrugated Metal Pipe as a storm sewer. A recent inspection of this pipe revealed practically no corrosion, no erosion. The sewer is good for many more years.

LOW COST THROUGH LONG LIFE

Armco Corrugated Metal Structures have been used as storm and sanitary sewers throughout the country for the past half-century. Many of these are still giving good service today. This durability, coupled with low maintenance costs, assures long-term savings with Armco Corrugated Metal Structures.

Over the years since the Pocatello sewer line was installed, Armco's continuing research program has developed even more durable products to meet severe corrosive

and erosive conditions. For information on the newest of these improved products—Armco SMOOTH-FLO® Sewer Pipe—just fill in and mail the coupon.

Armco Drainage & Metal Products, Inc., 4369 Curtis Street, Middletown, Ohio.

ARMCO DRAINAGE & METAL PRODUCTS, INC.

4369 Curtis Street, Middletown, Ohio

Send me the folder "Armco SMOOTH-FLO Sewer Pipe."

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*now a residual
pre-emergence herbicide
with*

GEIGY SIMAZINE* 50W

7 safety
features

STOPS WEEDS AND FIRES BEFORE THEY START

Weed control is an old problem to maintenance men. Now Geigy's pre-emergence herbicide Simazine 50W provides a new and better solution — makes weed control *easier* because it is long residual; *safer* because of its Seven Safety Features; and *more effective* because it stops weeds before they start.

ONE APPLICATION PER SEASON

At the rate of 20 lbs. per acre, one pre-emergence application of Simazine 50W controls most annual broadleaf weeds and grasses for an entire season. For longer residual control, or for control of more resistant perennials, use 30 to 40 lbs. per acre.

SEVEN SAFETY FEATURES

Maintenance men especially appreciate Simazine 50W's Seven Safety Features. This new herbicide is safe to humans and animals, non-flammable, non-corrosive, non-abrasive, and presents no conductivity problem or drift hazard. Check the panel for these and all of Simazine 50W's Seven Safety Features — and compare.



WRITE FOR TECHNICAL DATA

For additional product data, Technical Service information, or the name of your nearest Simazine 50W distributor, address: Geigy Agricultural Chemicals, P. O. Box 430, Yonkers, New York.

ORIGINATORS OF **Geigy** DDT INSECTICIDES

check these **SIMAZINE 50W** 7 safety features

- 1. SAFETY TO HUMANS AND ANIMALS**
Extremely low toxicity. No need for protective clothing.
- 2. SAFETY TO ADJACENT VEGETATION**
Minimum lateral leaching. Remains where it is applied.
- 3. SAFETY TO SPRAYING EQUIPMENT**
Non-corrosive or abrasive to equipment.
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Relatively low electrical conductivity.
- 5. SAFETY FROM DRIFT HAZARD**
Works through roots—little or no toxicity to foliage.
- 6. SAFETY FROM FIRE HAZARD**
Non-flammable. No application hazard.
- 7. SAFETY ON VALUABLE LAND**
Not a permanent soil sterilant.

GEIGY AGRICULTURAL CHEMICALS
Division of Geigy Chemical Corporation
Saw Mill River Road, Ardsley, New York

* "SIMAZINE" is a trademark of Geigy Chemical Corporation

Although the emphasis in the Foundation has always been weighted heavily toward "pure" science, it has substantial funds available for the engineering sciences but is limited by law to basic research. Starting in 1951 with only \$42,000, engineering sciences expenditures have gradually increased to an estimated \$2.6 million during the present fiscal year. Some of the typical projects are described and suggestions for obtaining research grants are given. The remainder of the articles report on specific research activities ranging from "Reaeration of Oxygen - Deficient Natural Streams" to "The Effect of Monochloramine and Chromate on Bacterial Chromosomes." Other investigators report on research on "The Carrying Capacity of Water Mains"; "The Electron Microscope As An Aid in Water Quality Research and Control"; "Identification of Organic Wastes in Soil, and Oil Carriage of Sewage"; "Oxidation Studies" using activated sludge; "Disinfection of Sewage Sludge by Halogens"; "Resuspension of Solids in Sedimentation Basins"; "The Role of Algae in Pollution Abatement"; "Determination of Radioisotopes in Water, Food and Sewage"; "Disposal of De-watered Fresh Sewage Sludge"; and

"Sewage Sludge Thickening by Flotation." These articles describe briefly the work of the individual with an idea that may foretell the engineering developments and practices that may be standard in the next few years.

"Sanitary Engineering Research"—a series of articles by individual investigators. **PUBLIC WORKS**, December, 1958.

Other Articles

"Sewage Sludge as Soil Conditioner."

The material on the practice, hazard, acceptability, value and experience in the use of sewage sludge as soil conditioner was obtained from available research data on the subject and from questionnaires circulated to state sanitary engineers and plant superintendents throughout the United States. By The Editors of Organic Gardening and Farming Magazine, Emmaus, Penna. **Water and Sewage Works**, November, 1958.

"High-Rate Biological Filters—Development and Design." A two-part presentation of a prize-winning paper prepared for the Sixth Congress of the Inter-American Association of Sanitary Engineers held in San Juan, Puerto Rico. Part II—Application of NRC Formula for Design of Filters. By F. G.

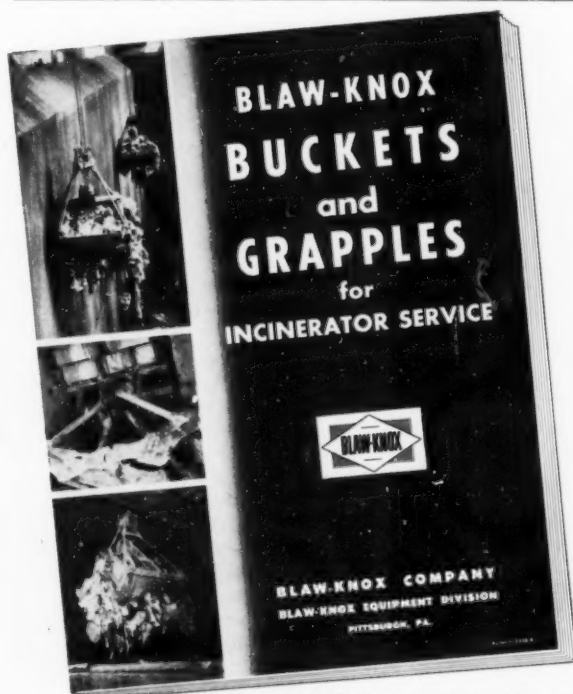
Nelson and K. H. Lanouette. **The American City**, November, 1958.

Sanitary Engineering Research. In the December, 1958 issue considerable space was devoted to research activities in the field of sanitary engineering. It was possible, however, to present only the highlights. The purpose of this presentation was to make all public works engineers conscious of the scope, the needs for and the great returns available from research and development. Recommended reading. **Public Works**, December, 1958.

"Solids Control Problems in Activated Sludge." The purpose of this paper is to display the qualitative and quantitative impact of varying, by autogenous biochemical action, volatile solids and/or ash content of a given sample of activated sludge. By E. O. Dye. **S & IWA.**, November, 1958.

"The Significance of Detention in Sedimentation". A discussion of Overflow Rate Concepts by N.C.H. Fischerstrom and Detention Time Concepts by E. B. Fitch. **S & IWA.**, November, 1958.

"BOD Progression in Soluble Substrates." Biological oxidation proceeds in two phases, involving first, conversion of the material into cell substance, and second, utilization of stored decomposition products and of cell substance. By A. W. Busch, **Sewage and Industrial Wastes**, November, 1958.



HELPFUL TIPS! Write today for your free copy of Bulletin 2350 R-1. You will find many helpful answers to design and operating problems from the standpoint of efficient handling practice.

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PUBLIC WORKS DIGESTS

Prepared by

ALVIN R. JACOBSON, Ph.D.

Associate Professor and Head,

Division of Sanitary Science,

Columbia University School of Public Health

THE WATER WORKS DIGEST

Streamlining Meter Service

The Elizabethtown Water Company, New Jersey, has streamlined its meter repair operations due to the skyrocketing meter repair load brought about by the upsurge in housing development since World War II. In working out the details of the new shop, extensive time-motion studies were made of the various operations involved. In setting up the new shop, the basic concept was that of working on 10 meters as a group since 90 percent of the meters repaired are $\frac{3}{8}$ -inch, the production line was laid out to handle this size. The article contains a series of nine photographs showing the shop equipment and the sequence of meter servicing operations. Meters larger than $\frac{3}{8}$ -inch which can be handled in the shop are repaired and tested on separate test benches. Meters in the 1-inch size range, and larger are carried on similar carts, and the repair work is performed on separate benches as shown in additional photographs. Meters larger than 2-inch size are usually tested in the field during the summer.

"Streamlining Meter Servicing." By James Girard. *Water Works Engineering*, November, 1958.

Detroit's Water Treatment Plant

Detroit has proceeded with the construction of distribution and treatment facilities needed immediately to augment the present water works. These improvements include a booster station on the raw-water tunnel at Water Works Park, and a 200-mgd addition to the Springwells Station. The Springwells expansion consists of the installation of larger pumps in the existing low-lift and high-lift pumping stations and the construction of additional purification-plant capacity. An additional filtered-water reservoir is to be built later. The raw water is pumped from the Detroit River to rapid mixing basins where liquid alum, carbon slurry and chlorine may be fed before the water proceeds to the flocculating basins. Each flocculating basin is divided longitudinally into

five parallel-flow sections. Flow of water to the basins is controlled by valved inlet ports. A perforated baffle wall between the flocculating chambers and the settling compartments provides distribution within each basin. Settled water flows to the 40 new filters through two parallel box conduits. The settled-water conduits extend along the sides of the filter building and feed the filters from the outside rather than from the filter gallery. Each filter bed will be equipped with twelve rotating surface sweeps of 9-ft. diameter. Each of the new facilities are described in considerable detail. General excavation for the basins and filter building was completed by contract at a cost of \$238,595 while the general contract for completion of the water treatment plant is by a bid of \$9,796,000 to be completed by June 1, 1959.

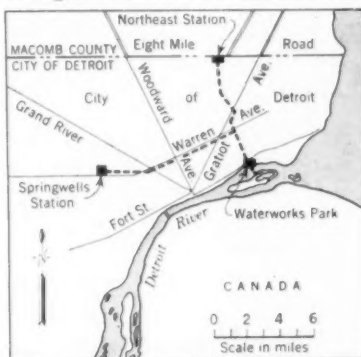
"\$10 Million Adds 200 Mgd to Detroit Water Treatment Plant." By Alfred W. Sawyer and Remig A. Popp. *Civil Engineering*, November, 1958.

London's 19-Mile Tunnel Main

A \$15-million water supply scheme is due to come into operation at London, England, early in 1960 when a 19-mile long tunnel main now being constructed beneath the city is completed. This main will draw raw water from the River Thames at Hampton, on the southwestern fringe of the city and carry 70 mgd to reservoirs in the Lea Val-

ley area in the city's northeastern section. The project aims at easing a serious burden on existing supplies in this heavily populated sector of London. At present these areas draw about 45 percent of water supplies from the River Lea; 37 percent comes from the Thames in existing mains; 17 percent from wells; and 1 percent from gravel pits. Reduced supplies from the River Lea have caused anxiety over a number of years, especially during drought conditions. This deficiency was formerly made good by a standby reserve of filtration plant and pumping capacity in the Thames Valley on the other side of the City. Existing mains were used to deliver larger than usual quantities of filtered water to the central and eastern sections but this did not supply the needs. Plans were adopted by the Metropolitan Water Board and work on the tunnel main began in 1954. Twenty-two shafts, varying in depth from 67½ to 192 ft., will have been sunk along the 19-mile length of the tunnel when it is completed. All shafts are 12 ft. in diameter with the exception of the terminal one in the Lea Valley which is 25 ft. Present plans include the installation of 7 pumps, including standbys and one for dewatering the tunnel. Conventional steel pipes and cast iron segments have been replaced as tunnel lining methods by precast concrete segments resulting in a saving of about 20,000 tons of steel. An inverted U-shaped tunnel of "in situ" concrete is proposed for the building of the intake on the River Thames. After the water passes through the 19-mile tunnel it will be pumped up the terminal shaft and from ground level will go by trench main to four reservoirs in the Lea Valley area. The completion of this tunnel will prevent an ever-present threat of water shortage during dry spells in the east and central sections of London where a large proportion of the London Metropolitan Water Board's 6½ million consumers are residents.

"19-Mile Tunnel Main Beneath London." By William A. Heath. *Water and Sewage Works*, November, 1958.



● STATIONS involved in Detroit's water treatment expansion program.



**"Mister ---
what's
inside
besides
water?"**

**"That's a smart question, son . . .
and the answer is 'experience'."**

All Ludlow and Rensselaer hydrants are built for easy, dependable operation and long life, despite rough treatment and the most severe climate conditions. They're engineered for performance and meet all A.W.W.A. specifications. That's why they've been "watchdogs" of American property since 1861!

**SIMPLICITY OF DESIGN AND
OPERATION
ABSOLUTELY TIGHT CLOSURE
NO FREEZING
NO FLOODING DUE TO
STANDPIPE BREAKAGE**



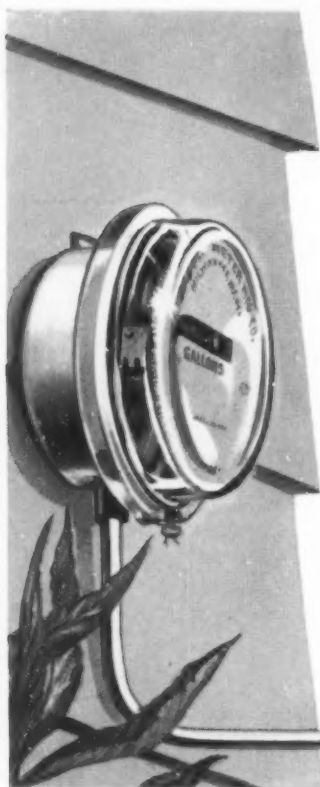
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VALVES AND HYDRANTS

THE LUDLOW VALVE MANUFACTURING CO., INC., TROY, N. Y.—SINCE 1861

PUBLIC WORKS for January, 1959

145



New! BADGER

Read-o-Matic ^{*}
REGISTER

adds speed-reading to water metering

Here is the industry's first practical outdoor register — the Badger Read-o-Matic. Now meter reading routes can be completed in half the time — with no more wasted calls. Plus other important benefits such as:

• *No more "lockouts"* • *No more in-house accidents* • *No more access problems* • *No more inconvenienced customers*

The new Badger Read-o-Matic means a modern meter reading system that your water department can have now — and opens a whole new realm of possibilities for the future. You'll want to read about them in our free new Badger Read-o-Matic folder.

*Pat. applied for in U. S. A. and foreign countries

Badger Meter Mfg. Co. • 4545 W. Brown Deer Rd. • Milwaukee 18, Wis.

Carrying Capacity of Mains

Efficient delivery of water is dependent upon the hydraulic characteristics of the pipe. Improper water quality may cause a gradual incrustation or tuberculation of the interior surface of the pipe thereby increasing pumping costs. Tubercles interrupt the normal flow of water over the surface and cause eddies or cross currents into the main body of the usual flow pattern. Closely spaced tubercles of an average height of a half-inch may reduce the carrying capacity of a 24-inch pipe by 45 percent. The Illinois State Water Survey, with the aid of grants from the National Institutes of Health, is studying the effect that treatment methods may have on the carrying capacity. The laboratory tests have shown that in the presence of dissolved oxygen, corrosion rates decrease for waters containing increasing concentrations of calcium and bicarbonate ions (usually expressed as alkalinity). A second form of incrustation is associated with lime-softened waters. Improper treatment with lime and soda ash has resulted in the precipitation and deposition of magnesium hydroxide in water mains. A rippled surface, due to this deposition,

only one-eighth inch thick in a 48-inch main may reduce the capacity to deliver water by 30 percent. A properly treated lime-soda softened water should not be supersaturated with magnesium hydroxide. As a general rule it may be said that the pH should not exceed 9.0 nor magnesium hardness 40 mg/L. These and other factors will undergo further study.

"Carrying Capacity of Water Mains." By T. E. Larson. PUBLIC WORKS, December, 1958.

Protective Coatings

Research has been in progress at Michigan State University which is directed toward developing procedures for anticorrosion protection for metal water pipes. All of the work was conducted with cast-iron and stainless-steel specimens exposed to demineralized waters containing only calcium hydroxide, carbon dioxide and dissolved gases of the atmosphere, oxygen and nitrogen. The tests were conducted under either of two conditions: static or dynamic. Some of the conclusions which the authors have drawn from the investigations thus far are: 1). Formation of protective calcite-limonite-siderite coatings on

cast iron occurred best when the specimens were corroded or when outside current was impressed through the specimens. 2). Coatings developed in the study acted primarily as cathodic inhibitors. 3). High flow rates were desirable for the formation of hard, durable coatings. 4). Better protection and better-bonded, harder, and tougher coatings resulted with solutions containing colloidal CaCO_3 , than from solutions of the same pH and hardness with no colloids present. 5). Low momentary excesses and high total excess of calcium carbonate led to the formation of tenacious, hard, protective coatings within a day. These basic studies will continue.

"Carbonate Deposits for Pipe Protection." R. F. McCauley and M. O. Abdullah *Jour. AWWA.*, November, 1958.

Radioactivity in Streams

The author summarizes his article by stating that: 1) Freshwater streams provide an important means by which to dispose of radioactive contamination. 2). The main potential sources of radioactive contamination in streams are the mining and smelting of radio-

active ores; effluents from atomic-products manufacturing; wastes from industrial, research, and medical users of radio-isotopes; accidents involving radioactive materials or nuclear-powered apparatus; and fallout from atomic detonations. 3). The chemical and physical properties of radioactive materials that can influence their dispersion in streams include their state, mass, density, radioactive lifetime, chemical state and the temperature of the effluent that bears them. 4). Nonbiotic, limnological factors that can influence dispersion of radioactive contamination include stream morphology, flow volume, velocity, temperature and water chemistry. 5). The biota of a stream can significantly affect the dispersion of radioactive contamination by accumulating and retaining certain radioisotopes, and by spreading the contamination through migration.

"Dispersion of Radioactive Materials by Streams." By Jared J. Davis. *Jour. AWWA.*, November, 1958.

Other Articles

"New Castle Sat on A 'Powder Keg.'" This is the blow-by-blow account of how a run-down, **dangerously inade-**

quate water system in a growing community was brought back to safe standards by quick decisions, quick planning, and quick action. It is also convincing proof of what happens when a water supply does not keep pace with a growing community. By Nelson Howard. *Water Works Engineering*, November, 1958.

"An Operator's Viewpoint of the **Membrane Filter Technique.**" New procedure reduces laboratory and waiting time and revives interest in daily bacteriological examination. By George Hazey. *The American City*, November, 1958.

"Reversible **Diatomite Filtration.**" By reversing the direction of flow of water through the filter medium, both sides of the membrane are used alternately. By Judson G. Brown. *Water and Sewage Works*, November, 1958.

"Field Testing of **Centrifugal Pumps.**" Part II. In this second of two parts, the author discusses the calculation, plotting and interpretation of results. Part I appeared in the July, 1958, issue and detailed the steps required in planning and conducting field tests. By Fred W. Beltz, Jr. *Water and Sewage Works*, November, 1958.

"The Effect of Monochloramine and Chromate on **Bacterial Chromosomes.**" The authors report on some research work in progress concerning the mechanism of action of monochloramine and of chromate ions causing the production of a number of chromosome aberrations in bacterial cells. By Robert

S. Ingols. *Public Works*, December, 1958.

"Current Research on **Corrosion and Tuberculation of Cast Iron.**" A report of the research being conducted by the Illinois State Water Survey on the effects of mineral content on the corrosion and tuberculation of cast iron pipe with specific reference to loss in carrying capacity through tuberculation. By T. E. Larson and R. V. Skold. *JAWWA.*, November, 1958.

• • •

Allowance for Water Main Extension Cost

In extending water mains, Lebanon, N. H., allows \$300 per customer against the cost of the work. If only one house is served, the charge will be the cost minus \$300. In case the cost is \$1500, and there are five customers, the Water Department will make the extension free of charge.

Desalting Sea Water Studied

A study to determine the feasibility of desalting 10 to 20 million gallons per day of sea water with nuclear energy is being made in California. Federal and State funds have been used to contract with a research organization which will utilize in its study the heat of nuclear reaction for desalting.

Here's the big news behind the industry's first practical outdoor register

The Badger Read-o-Matic is powered entirely by the meter to which it is attached . . . works on an exclusive "pulse" principle. As water flows through the meter, the generator sends a pulse by wire to the Badger Read-o-Matic register outside for accurate recording.

Like our Badger meters, the Badger Read-o-Matic is precision-engineered — thoroughly tested by our trained water meter experts in the laboratory and in the field. Badger Meter products are the result of over 50 years of specialized water meter experience — products that excel around the world in accuracy, durability, dependability and low maintenance cost.



Send for free, colorful brochure that tells you all about the revolutionary Badger Read-o-Matic. For an actual demonstration, see your Badger representative or write us direct.

Badger Water Meters

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Moving Hydrants the Easy Way



REMOVING A number of hydrants and standpipes preparatory to widening Greenfield Road in Detroit, the Detroit Water Department uses its Model HU "PAYLOADER" tractor-shovel equipped with an 18-in. Wain Roy backhoe. The Hough easily lifts the combined weight (1500 lbs.) of the hydrant and standpipe from the 6½-foot hole.

A great variety of work now can

be handled with the Hough-Wain Roy unit as the backhoe attachment has 190° digging radius and 12-foot digging depth. One of the first jobs assigned to the Hough unit was the laying of a 6-in. water pipe right against a fence for service to a supermarket. By excavating at right angles to the machine, the City completed the job with considerable savings in time and money.

Outdoor Lighting for a New Group of State Office Buildings

ORIGINATING in Albany, N. Y., the "Campus Site" concept came into being as a long range plan to integrate major state office buildings into a closely-knit but uncrowded grouping with park like surroundings. For this purpose a large plot of several hundred acres was acquired on the western side of the City of Albany.

Since downtown office buildings were faced with difficult parking problems for state employees, provisions for adequate and safe parking were considered as extremely important in the design of the Campus Site. And for adequate and safe parking, proper lighting was a prime consideration. It was felt that uniformity was more important than high levels of light.

Consequently when the first two buildings, representing approximately one-seventh of the entire project, were erected, a large parking area was also provided. Light



● **UNIFORMITY** of lighting was an important consideration for the parking areas and roads serving the New York State office buildings arranged on a "campus site."

levels were designed for 0.6 foot-candle in the parking area proper and approximately one half that value for the entrance roads.

Westinghouse Type OV-20 luminaires were chosen as the desired equipment for this installation as the streamlined lines of this unit would blend with the modern buildings. Operated with 6,000 lumen incandescent lamps, the superior photometric performance of these units insured the excellent uniformity and efficiency desired and rugged cast aluminum housing guarantees long and dependable service life. Monotube aluminum poles made by The Union Metal Mfg. Co. were used to present an attractive and a high quality lighting job.

The system is fed from two 6.6-ampere series circuits, arranged so that after midnight only the perimeter lights remain burning. Safety is further assured by the use of individual isolating transformers which eliminates high voltage above ground level. Control is photoelectric "on" for both circuits, time switch "off" for interior circuit at midnight and photoelectric "off" for perimeter circuit.

• • •

Street Cleaning in San Francisco

STREET CLEANING is done by four methods, or a combination of these: 133 blockmen sweepers who individually patrol assigned commercial sections of the City; 11 gang sweeping crews in assigned residential districts; a fleet of 11 motor sweepers; and 8 motor flush-

ers. This work is supplemented by the operation of 10 litter control trucks which are primarily used for emergency clean-ups, answering complaints and periodic patrolling of known "paper pockets" throughout the City.

The Bureau has established a training program for new employees. These men are assigned to a crew under a sub-foreman whose duty is to instruct the men in their work and to determine whether or not they should be recommended for continued employment. A copy of the Rules and Regulations of the Bureau including instructions as to work hours, safety and public relations is given to the employee and fully explained by the sub-foreman. The training period is from four to six weeks after which the employee is given a permanent job assignment as vacancies occur in the Bureau.

In the operation of the 11 motor sweepers the fibre core of each sweeper must be replaced after an average of 194 miles of use, totaling 240 cores per year. The refibering of these cores has always been done by private contract and in the last few years the cost per unit has sharply risen to a current price per core varying from \$32 to \$37 depending on the type of equipment. Correspondence with several municipalities which are refibering their own sweepers with automatic machinery indicates that this work can be done at a cost far under the price now being paid. If further studies being made confirm these facts a request for funds to purchase an automatic core refibering machine will be made in the 1958-1959 budget.

The biggest problem faced by the Bureau is the clean-up of papers, cartons, wrappings and litter illegally left on the sidewalks by commercial establishments and the distributors of newspapers and advertising "throw-aways." Ten litter control trucks patrol the City picking up this discarded material from the many known locations where the ever present west wind deposits such litter. All of this occurs despite an active campaign waged by the Bureau and civic minded agencies.

During the past year the first one-man litter patrol truck was placed in operation. This unit is equipped with a two-way radio unit and is dispatched to areas for minor clean-ups as a result of vehicular collisions, truck spillages and other reported incidents requiring the Bureau's services. The operations for the first year proved highly sat-

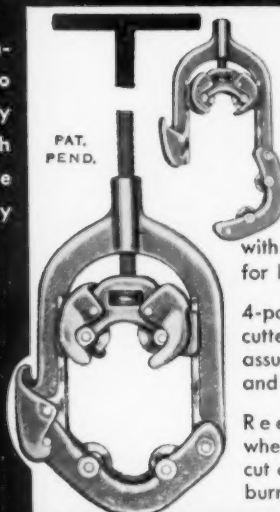
IF YOU CUT LARGE DIAMETER PIPE... YOU NEED THESE

New **REED**

**HINGED
4-WHEEL PIPE CUTTERS**

Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

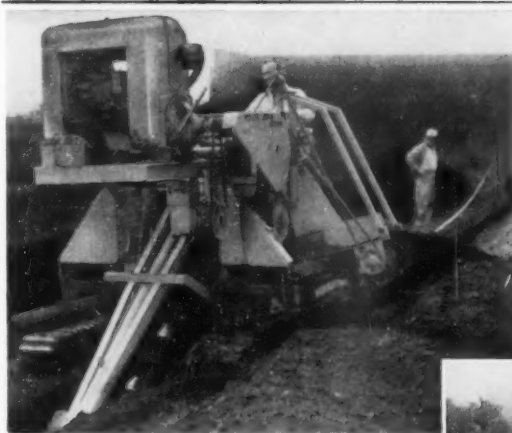
4-point guide aligns the cutter on the pipe... assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

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Rugged, Inexpensive VERMEER POW-R-DITCHERS

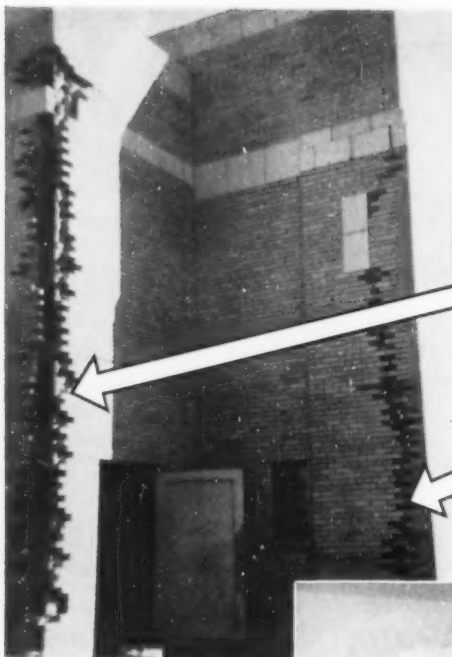
If one of your problems is low-cost, time-saving trenching and ditching... take a look at the VERMEER POW-R-DITCHER line before you buy! The 524T (above) digs 8" to 24" wide. The 4T (right) digs 6" to 14" wide. Both are fast, rugged, self-propelled and low in price. Ideal for digging foundation footings, gas, water, sewage and service lines. A third smaller unit also available.

**Write For Literature and Low
Prices On The Complete Line**

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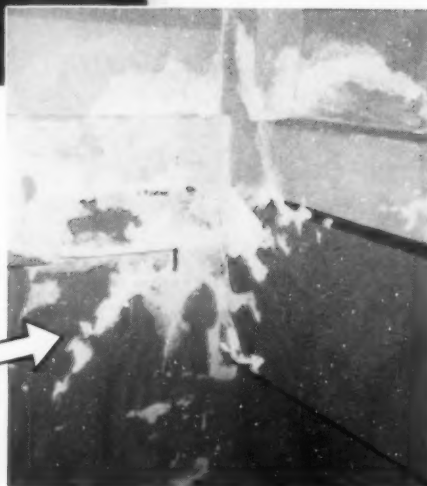


Which Size For YOU?



**Water
almost
ruined
this
building**

**Costly plaster
damage inside
of building
caused by water
seeping through
from cracked
walls**



Water entering through cracks in exterior walls of this expensive brick building caused corrosion of structural columns and beams, making brick walls bulge and crack.

Columns were coated and brick masonry relaid and repointed with DRYJOINT Pointing Mortar and entire building given one coat of THOROCLEAR invisible waterproofing.

Thousands of schools and hospital buildings need THOROCLEAR to keep water out of the masonry walls.



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isfactory as a means of saving manpower and equipment costs in the release of a larger truck and three men to other duties.

Prior to the anticipated rains last winter a two-man crew cleaned 18,577 catch basin and storm water inlet grates of paper or debris which might block the entrances to these rain water inlets. This was a new project carried out as a means of cutting down the number of flooded street areas which usually occur with the first heavy rains.

A summary of the Bureau operation shows the following: 248,549 miles of motor truck operation, exclusive of sweepers and flushers; 116,266 cubic yards of street litter removed; 46,518 miles of sweeper operation; 71,325 miles of motor flusher operation; and 18,557 catch basin and storm water inlet gratings cleaned.

This material was abstracted from the Annual Report of the Department of Public Works, City and County of San Francisco for the fiscal year ending June 30, 1957. Sherman P. Duckel is the Director, Department of Public Works.

• • • **Old Photographs of Public Works Activities Wanted**

The Hollywood film producer who made the film "Collectors' Item" about rubbish collection is preparing to produce another film for the same sponsor, this one featuring the several public works services: Water, sewers, sanitation and streets. The title will be "Headline For Harper." The dramatized story will show improvements in each of these services which have taken place in one man's life-time. Although the screen time will concentrate on what the citizen gets today, each service will be introduced by an "in the old days" bit. This will be done with old photographs, of the period 1890 through 1910, showing the conditions of the times (and the need for improvement) in water; sewers; refuse collection and disposal; street construction, maintenance and sanitation (including snow); street lighting; and traffic control.

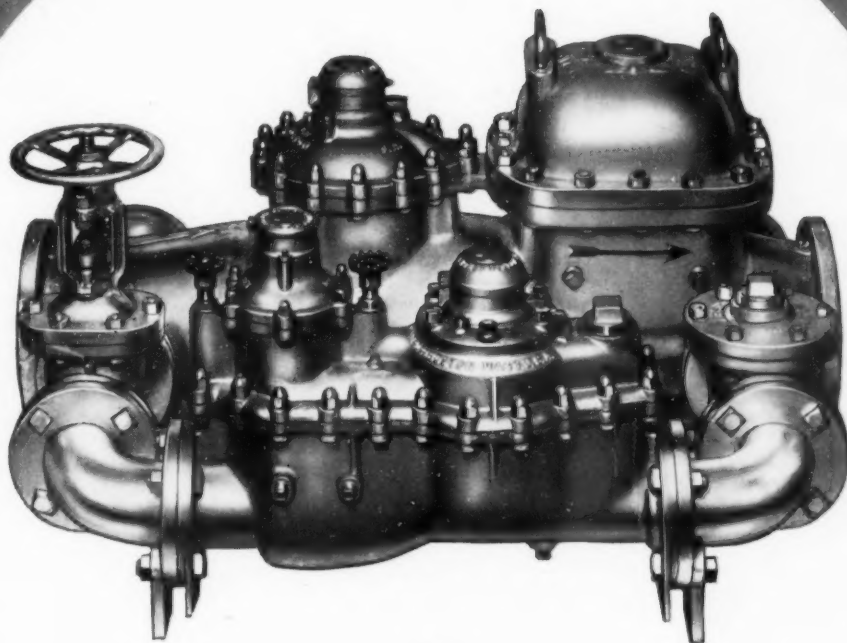
The producer is anxious to get a selection of the best possible old photographs. He promises to take utmost care of any photographs loaned, to duplicate them promptly and return the originals a few days after receipt. Photographs should be sent to Parthenon Pictures (Attention: Mr. Sam Farnsworth), 2625 Temple Street, Los Angeles 26, California.

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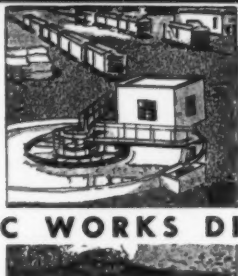
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PUBLIC WORKS DIGESTS

Prepared by

CLAYTON H. BILLINGS

Associate Editor

THE INDUSTRIAL WASTE DIGEST

Computers for Air Pollution Study

In handling the problem of isolating the specific chemicals involved in air pollution, there are two major difficulties. First, photochemical reactions occur resulting in ozone formation from hydrocarbons and oxides of nitrogen. Secondly, pollutant distribution involves physical and chemical phenomena occurring simultaneously. The concentration of specific pollutants at a given location is affected not only by their original concentration but by sunlight intensity, wind velocity, diffusivity, the inversion layer, and the local terrain. Mathematic formulation of the variables leads to a series of ordinary and partial differential equations too complex to be solved analytically. An approximate mathematical model can be formulated of the physical factors involved in diffusion of the pollutants and of the photochemical reactions occurring. The model has been programmed on an electronic analog computer to demonstrate that analog techniques are potentially useful for predicting the concentration of chemical reactants in the atmosphere. It is possible to investigate the effect of variation in light intensity during daylight hours as well as time-varying input concentrations of nitrogen dioxide such as occur over highways and streets.

"Atmospheric Diffusion of Air Pollutants, Analog Computer Study." By W. J. Karplus, G. A. Bekey, and P. J. Pekrul, *Industrial and Engineering Chemistry*, November, 1958.

Separation of Atmospheric Pollutants

Both qualitative and quantitative analyses of organic particulate matter involved in atmospheric pollution by combustion of hydrocarbon fuels have been tedious because of the numerous compounds and the minute quantities of each. Chromatography has been used for separation but resolution is poor. Fractional sublimation may be used for resolving larger quantities of material. Obtaining large amounts of the various compounds is important in order to test carcinogenic activ-

ity. In fractional sublimation, the sample is placed in a tared boat in a glass tube which is then evacuated. The tube slides through a cooling jacket into a furnace which allows a linear temperature gradient to be established along the tube. The mixture vaporizes from the boat along the tube at a rate which is a function of the pressure and temperature. The fractions obtained by sublimation are separated by cutting the tube into sections which are then chromatographed. The presence of a single band on a chromatogram is used as an indication of a pure sublimate fraction. While interference in sublimation is encountered from the presence of resins, the resin can be separated chromatographically and does not interfere with the chromatographic techniques.

"Fractional Sublimation Technique for Separating Atmospheric Pollutants." By J. F. Thomas, E. N. Sanborn, M. Mukai, and B. D. Tebbens. *Analytical Chemistry*, December, 1958.

The Case of the Striped Bass

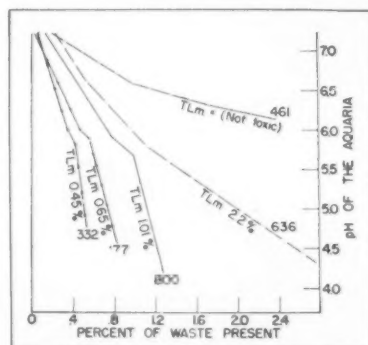
A fish kill of major proportions along the east shores of San Francisco Bay led to investigations by all official agencies to determine the cause. This article is concerned with the evaluation of the toxicity of a waste from a chemical manufacturing plant which included such toxic agents as sulfuric acid, hydrofluoric acid, sulfur dioxide, copper, zinc,

iron, lead, and arsenic. Bioassay procedures were employed using the native juvenile striped bass in a salt water environment. From the observed data and by comparing the chemical composition with known toxicity data, all components except pH, acidity, fluorides and sulfur dioxide were ruled out. Attempts to demonstrate correlation between increasing concentrations of acidity and toxicity were not satisfactory. Similar results occurred in the case of fluorides. The best degree of correlation was obtained between the initial pH of the waste and toxicity. When the effect of pH was further evaluated by plotting the pH values of the aquaria against waste concentrations, it became evident that those wastes which had the greatest ability to lower the pH of sea water were the most toxic. However, when the pH was buffered to 7.5 and 7.7 a slight increase in toxicity of the most toxic waste was observed with increase in concentration of the waste. These results seemed to indicate that a more specific toxic agent than pH had effect in the higher concentrations of the waste, but attempts to isolate the constituent failed. It was concluded that a combination of internal and/or environmental factors or a sort of synergistic action of all or some of the components cause the waste to be toxic at pH values of 5.5 or below.

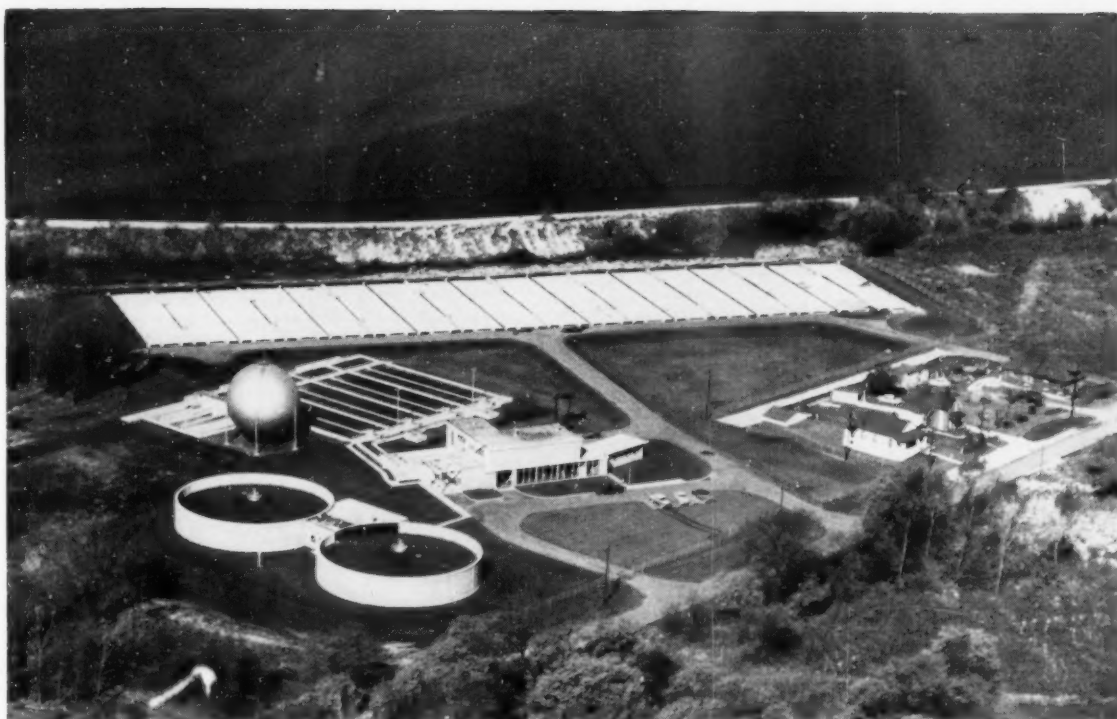
"A Complex Chemical Waste and Its Toxicity to Fish." By Gerson Chanin and R. P. Demoster. *Industrial Wastes*, November-December, 1958.

Incineration of Cyanide Wastes

The cyanide wastes from the Wayne, Michigan, plant of the Detroit Diesel Engine Division, General Motors Corporation, include skimmings from molten salt heat-treating baths and rinses and sludges from the electro-plating of copper and cadmium. The waterborne wastes are handled in a treatment plant utilizing chlorination and precipitation processes, followed by biological treatment of the combined effluents. While the cyanide-bearing



Industrial Wastes
● TOXIC effect of wastes becomes greater as the pH level is reduced.



Joliet's new sewage treatment plant will help to restore the cleanliness and utility of the Des Plaines River and to serve as an example to the cities and industries who are still contributing to the river's pollution. Consoer, Townsend and Associates, Consulting Engineers, Chicago.

New plant at Joliet, Illinois employs P.F.T. "Controlled Digestion"

Designed to accommodate a population increase of more than $\frac{1}{3}$, the sewage treatment plant at Joliet will be "new" for years to come. This progressive city is located on the Illinois Deep Waterway and has a present population of some 60,000.

The P.F.T. "Controlled Digestion"

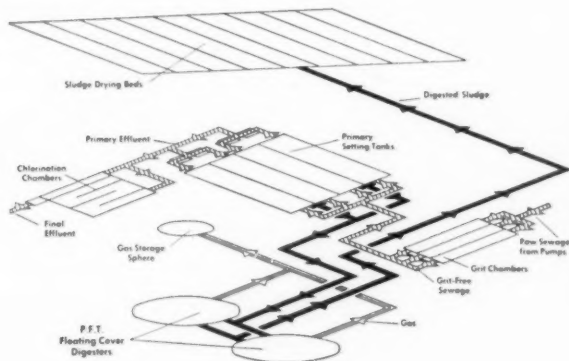
system incorporated into this plant includes: two P.F.T. 85' Floating Covers, two of P.F.T.'s #750 Sludge Gas Fired Heaters, two Floating Cover Position Indicators, Gas Safety Equipment and two P.F.T. #450 Shell and Tube Heat Exchangers.

Here is a flow diagram of this new

plant. It is designed to effectively treat an average flow of 15 million gallons per day expected from the future population of 82,900.

No wonder Joliet is proud of this modern plant. Information on any of the P.F.T. equipment used in this installation will be sent upon request.

Flow Diagram of Joliet Plant.



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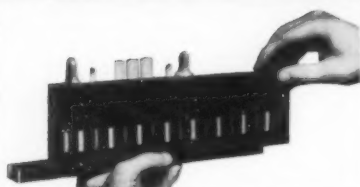


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solid wastes could be dissolved and processed in this plant, an incineration technique was developed which proved to be far more convenient and economical. The molten salt baths employed for case hardening low carbon steel parts, contain sodium cyanide and are subject to cyanide degradation by oxidation. Removal of the surface layer at frequent intervals is necessary in order to maintain a desirable bath composition. The storage of the skimmings presents a problem because of the necessity of maintaining a locked minimum-access enclosure. Incineration of the solid wastes provides a solution to the storage problem, and the pick-up operation could be scheduled into the waste control program. The incineration procedure developed involved the pulverization of the solid wastes by tumbling them in a rotating barrel in the presence of scrap iron. The barrel is equipped with hollow trunnions, one of which serves as an air inlet, and the other is connected to the incinerator in such a way that the compressed air flow to the burner causes an induced air current through the barrel. As the cyanide is pulverized and converted to dusty particles, it is picked up by the induced air draft and carried to the incinerator. The total air mixture enters the incinerator retort around the fuel nozzle and serves as the principal air supply for combustion of the solvents and the cyanide. The process proved fully satisfactory as a means of disposing of the solid cyanide waste; as much as 3 lbs. of the waste containing 20 percent CN can be burned completely for each gallon of waste solvent fuel consumed.

"Solid Cyanide Waste Incineration from Diesel Engine Manufacture." By C. F. Gurnham and C. T. Gruner. *Industrial Wastes*, November-December, 1958.

Oxidation Research

In a study of total oxidation of wastes it is assumed that the influent substrate is converted to new activated sludge solids and that the activated sludge organisms totally destroy and assimilate themselves. The desired net effect is to have the activated sludge destroy its own weight equivalent to the weight of new activated sludge being produced from the influent, avoiding the necessity for disposing of sludge. Previous studies on milk wastes involved a batch process to provide a resting period. The present project

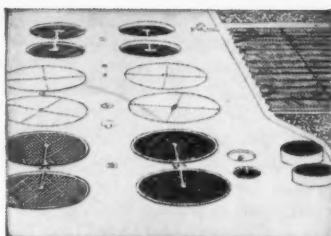
utilizes a continuously-fed unit with the intent of eliminating the resting period. Six one-hour aeration tanks are provided, operating in series, followed by a clarifier. The sludge is removed regularly from the clarifier and is returned, so that all of the activated sludge is kept in the system. The influent is a solution of skim milk powder, fed continuously. Equilibria were achieved which show the weight of activated sludge in the system to be 12 to 15 times the daily influent weight of total volatile solids. Thus in designing such a system, the engineer can vary the volume of the aeration unit and obtain most any activated sludge concentration desired. A treatment plant following these principles can be constructed and operated more economically than conventional types.

In the study of oxidation of cyanides, activated sludge cultures were developed first using domestic sewage and were then slowly converted to those which would exist on an influent containing potassium cyanide. The cyanide oxidation is performed in three-liter glass test tubes located in a constant temperature (72°F) water bath. A clock mechanism meters and adds the cyanide solution to the aerated test tube cultures. The excess air escaping from the tubes is scrubbed in a gas washer in order to trap and measure any cyanide and/or ammonia which may have been sparged from solution. The supernatant is also analyzed. At present, two three-liter cylinders are being fed 60 and 120 mg CN⁻ per day. During normal operations no CN⁻ has been detected in the supernatant of either cylinder. Less than 0.5 mg/day is sparged from each cylinder.

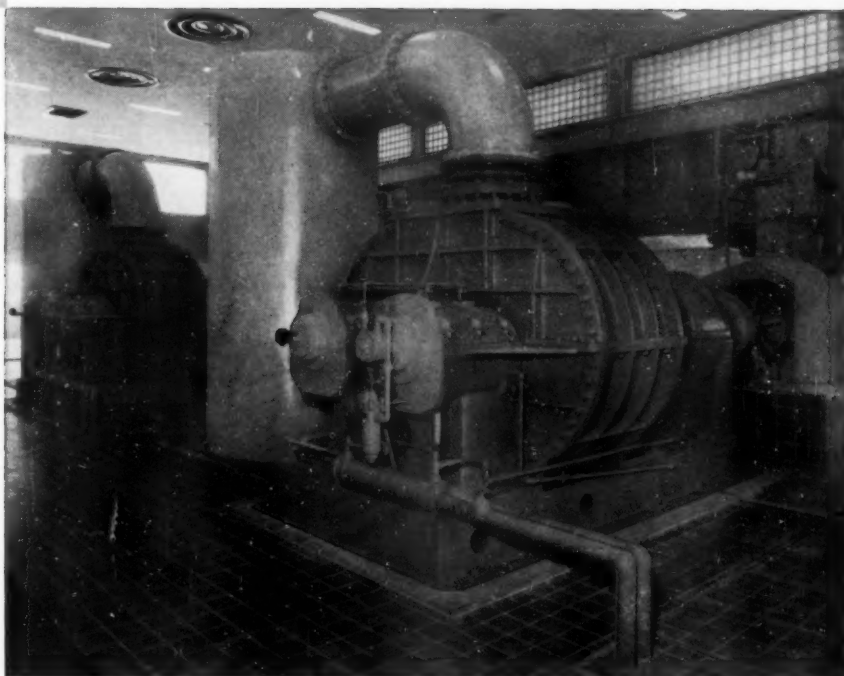
"Oxidation Studies." By R. R. Kountz and J. B. Nesbitt. *PUBLIC WORKS*, December, 1958.

Metal-Handling Waste Treatment

In order to meet limitations imposed by the City of Pontiac, Michigan, on the concentrations of certain toxic chemicals discharged to its sewer system, the Pontiac Motors Division of General Motors contracted in 1955 for a survey of the waste disposal problem and in 1956 for the design and construction of a plant to treat the wastes. There are six different wastes, each of which is conducted separately to individual holding tanks and is kept and treated separately until all wastes are united and discharged to the sewer system. The wastes are



For waste treatment



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Sprague & Henwood's sampling equipment is designed for long, dependable service with a resulting minimum cost. The complete line of sampling devices and equipment is described in the new Bulletin 300.



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strong (from dumps) and weak cyanide solutions, non-toxic alkalies and acids, metallic-acid rinses containing chromium, strong metallic acids from dumps, and alkali-oily emulsions. The estimated total daily volume was about 1.74 million gals. The method of treatment selected for the cyanide was by alkaline chlorination. Separate holding tanks and pumps were provided for the strong cyanide wastes to permit independent control of the volume subjected to treatment. Bubble type controls were furnished for all holding tanks with indicators on a central control panel to facilitate the determination of acceptable blending of the wastes according to the volume and concentration. Chlorine addition is controlled by ORP equipment. Three chlorinators are used, each with a capacity of 6000 lbs. per 24 hours. Other features of the treatment plant include duplicate holding tanks and equipment, a storage volume equal to 48 hours plating room operation, automatic mixer controls from the bubble controls, polishing tanks to prevent discharge of improperly treated wastes, and carload handling of chemicals. Before discharge to the final clarifier, the contents of a polishing tank are analyzed and if found unacceptable they are recycled back to the appropriate holding tank.

"Pontiac Motors Treats Its Waste." Part I of two installments. By E. B. Besselievre. *Wastes Engineering*, November, 1958.

Other Articles

"Operating Problems of Industrial Wastes Treatment Plants." Six papers presented at the 1958 Spring meeting of the N. Y. Sewage and Industrial Wastes Association comprised a forum on operation. I. "Plating, Heat Treating and Painting Wastes." By J. M. Whalen. II. "Steel Manufacturing Wastes." By V. P. Traina. III. "Waste Acid Neutralization." By T. J. Tully. IV. "Oil Refining Wastes." By F. E. Ray. V. "Dairy Wastes." By A. H. Klein. VI. "Biological and Pharmaceutical Wastes." By C. G. Mauriello. *Sewage and Industrial Wastes*, November, 1958.

"Effects of Radioactive Materials on Anaerobic Digestion. II. Radiiodine." By Werner N. Grune, D. D. Bartholomew, and C. I. Hudson, Jr. It was found that rate of gas production, ultimate gas production, redox potential, gas quality, and uptake of radioactive iodine by the solid phase were not significantly affected by the presence of I^{131} in concentrations up to 100 mc/L in sewage sludge. *Sewage and Industrial Wastes*, November, 1958.

"Mill Scale Wastes." By G. A. Pettit. Removal of mill scale, oil and grease

from the wastes at the Armco Steel Corp., Middletown, Ohio, plant abated a sizable pollution load from the Miami River. *Industrial Wastes*, November-December, 1958.

"Liquid Industrial Wastes. Part II." By C. Fred Gurnham. In this second of a series of articles, measurements and criteria are discussed. *Industrial Wastes*, November-December, 1958.

"Elevated Temperature Effect on Citrus Waste Activated Sludge." By Marshall H. Dougherty and Robert R. McNary. During a pilot plant investigation of the activated sludge treatment of citrus wastes an elevation in temperature of the mixed liquor was noted. The effect of this on the activated sludge culture was studied and found to have little or no deleterious effects until at 43°C all protozoa were destroyed. *Sewage and Industrial Wastes*, October, 1958.

"Textile Waste Problems." By Robert S. Ingols. Characteristics of various types of textile wastes and advantages and limitations of treatment methods are discussed. *Sewage and Industrial Wastes*, October, 1958.

"Waste Treatment at a Quartermaster Laundry in France." By Werner N. Grune. Recommendations are presented for chemical treatment and chlorination to offset a problem resulting from official French complaints. *Industrial Wastes*, September-October, 1958.

• • •

HYDRANT HANDLING PROBLEM REDUCED BY PORTABLE HOIST

THE CITY of Portland, Ore., has found that portable hoists are a profitable investment. One man now does a job on hydrant service replacement that ordinarily would take two or three men. The hoist made by Burtchell Heating Co., of Portland, and operated off the power of the truck storage battery, has a capacity of 1,000 lbs. It provides power up or down; a 360-degree swing and automatic braking are other features of the hoist.



● **HOIST-equipped hydrant service truck of the Portland Water Bureau.**

Interesting Comparisons

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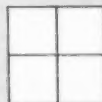
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Independent tests made by municipal engineers, using water supersaturated with oxygen, showed no appreciable effect on the efficiency of a diatomite filtration system.



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Reports from many municipalities show that from 2% to 10% of the previous filter run is required to backwash the sand bed.

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This may be considered as an "average"; individual circumstances set the actual costs in any specific installation.

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Dicalite Bulletin BW-13 contains much information on Dicalite filtration of potable water—clarity, purity, bacteria removal (95% or better) together with data and operating figures on diatomite filtration systems now operating in certain municipalities. Write for it—it's free.

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SELECTION OF FIRING METHOD FOR A SMALL STEAM PLANT

LEONARD B. IMMELE

Principal Engineer,
Burns & McDonnell Engineering
Company,
Kansas City, Missouri

SELECTING the firing method for a small steam power plant serving a municipal system is in many respects a more difficult selection than for a large central station.

If the electric system is isolated, as many of them are, the single power plant has to take the full range of load which quite often approaches three-to-one over a single twenty-four hour period. In many cases only one generating unit handles the complete system load through this period.

There is a wider choice of firing methods available to the small plant user. For coal firing alone there are pulverized fuel, continuous ash discharge (CAD) spreader stoker, dumping grate (DG) spreader stoker, chain grate stoker, and under-feed stoker.

Municipal plants are usually located in the limits of the city and quite often in residential or commercial sections of the city where stack dust emission, and dust from coal storage can be a serious problem. Firing method has considerable bearing on this problem.

Important factors to consider in selection of firing method are character of load, unit size, available fuels, generation cost, reliability, plant locality, and simplicity of equipment.

Units considered herein are of capacity up to approximately 150,000 pounds per hour.

Character of Load

Load ranges at which satisfactory and safe combustion is maintained varies with the different methods of firing. Table 1 shows expected load ranges for different firing methods, and indicates to a degree the effect on combustion efficiency of using full possible range. An "A" rating indicates sustained efficiencies throughout full load range. The table indicates the necessity of mul-

tiple burners and pulverizers for wide range loads. It also indicates that a chain grate might be more desirable than a CAD spreader stoker if low loads are to be carried for a high percentage of the life of the unit.

Speed of response of firing equipment to load changes is indicated in Table 2. An "A" rating means best response. This is important when load changes are sudden, frequent, and of significant magnitude if it is desired to maintain constant steam pressure and efficient combustion.

Unit Size

Pulverized coal firing generally does not prove out feasible for units smaller than 100,000 pounds per hour because of higher first cost, pulverizer maintenance, load range limitations, and auxiliary power cost. The dumping grate is usually limited to units smaller than 50,000 pounds per hour. Gas and oil are suitable for any size unit. CAD spreader stoker and chain grate firing is feasible for any capacity units normally associated with small power plants.

Available Fuels

It is important to select firing equipment which is adaptable to a wide variety of fuels. In so doing the user is in a better bargaining position when contracting for fuel. Consideration should be given to purchasing a unit that can readily be converted to using a second fuel where there is a possibility of the second fuel becoming available or of becoming the more economical fuel. Dual fired units are usually purchased when coal and gas, coal and oil, or gas and oil are competi-

tive in price. At the same time equipment must be selected to perform best with the fuel most likely to be used. For example if a 125,000-pound per hour unit is to be used on gas two-thirds of the time and coal the remaining time, a pulverized fired unit may well be the best choice because of better performance when burning gas in a unit designed for pulverized coal, as compared to one designed for stoker firing, and because of not having to shut down to transfer from one fuel to the other in order to protect grates or gas burners.

In selecting equipment for coal firing, it is wise to investigate the different sources of coal available and purchase the equipment which will perform best with the most economical fuel.

Pulverized coal firing may be adapted to almost any of the bituminous and subbituminous coals available. However, the cost of preparing the fuel for burning will vary considerably with grind ability, moisture content, and ash content. High grindability, high ash fusion temperature, high volatility, and low ash, moisture and sulphur content are desirable.

Table 1—Long Range Effect

Equipment	Range	Efficiency Rating
One Pulverizer	3:1	B
One Gas Burner	3:1	A
One Oil Burner	2:1 to 10:1	A
CAD Spreader Stoker	Wide	C
DG Spreader Stoker	Wide	B
Chain Grate	Wide	B

Table 2—Load Response Effect

Equipment	Speed of Response Rating
Pulverized Coal	A—
Gas	A
Oil	A
CAD Spreader Stoker	B
DG Spreader Stoker	B—
Chain Grate	C

CAD spreader stokers are adaptable to the widest variety of coals. This stoker is critical only as regards gradation in coal sizing and ash content. The coal sizing gradation must be held within certain limits to maintain a desirable balance between fuel burned in suspension and that burned on the grate. Ash content must be high enough to give the grate proper protection at all loads.

Chain grate firing is adaptable to most bituminous coals of the Midwest and East. There has been renewed interest in this method of firing in recent years because of improvements permitting use of a wider variety of coals. High coking coals are less desirable for this type of firing. Coal must contain sufficient moisture to maintain a porous fuel bed. Chain grate firing is not as restrictive as regards coal sizing as the CAD spreader stoker. It is important, however, that coal sizing be maintained fairly consistent with chain grate firing to minimize manual firing adjustments.

Generation Cost

It is a foregone conclusion that firing equipment should be selected to give the lowest total generation cost. The choice of firing equipment will affect first cost, fuel cost, maintenance cost, and possibly operating labor cost. Each installation must be evaluated as regards the above cost items to arrive at the best selection. Pulverized firing may show one to two percent higher efficiency than stoker firing but additional first cost, auxiliary power cost, and maintenance cost associated with pulverized coal could still make the stoker fired job more economical. It is possible to get three to four percent higher efficiency with stoker firing than with gas firing. In actual practice this much difference is rarely obtained because the gas firing efficiency is maintained much more easily at all loads, and gas fuel is of constant quality as compared to coal. Maintenance costs increase in the order of gas, oil, chain grate, spreader stoker and pulverized coal firing. Higher sulphur content of fuels represents higher maintenance cost.

Reliability and Simplicity

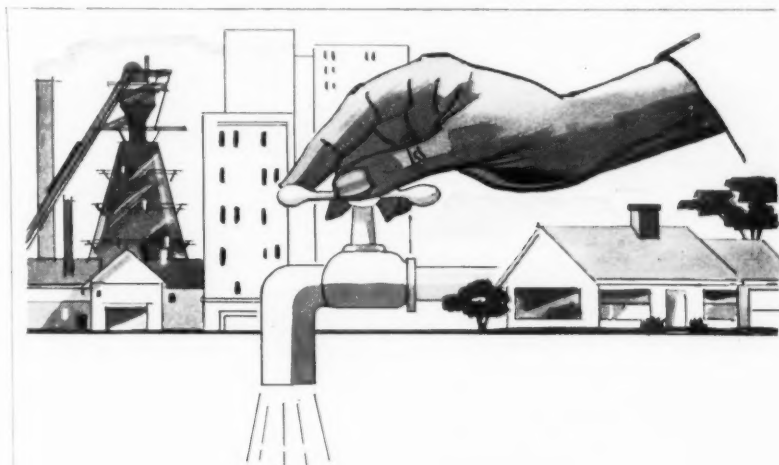
From the equipment standpoint only, there is very little difference in reliability between the different methods of firing providing the installation is properly engineered and equipment is of proven design from a reputable manufacturer. Reliability is more affected by continuity of

fuel supply, operating methods, and control over quality of fuel entering the plant.

In a well designed pulverized fuel job without electrostatic precipitator, 12 percent of the ash in the fuel may pass out the chimney. In a well designed spreader stoker job without electrostatic precipitator anywhere from five to ten percent of the ash will pass out the chimney depending on the percent of fines in coal and upon the care taken in firing. In a well designed, properly fired chain grate installation dust emission from the chimney is usually well under the re-

quirements of municipal codes regulating dust from chimneys. Therefore, final selection of firing equipment may be determined by the locality in which the unit is to be situated.

Generally the smaller the unit, the greater is the need for it to be simpler to operate and maintain. Less money is available for supervisory control and instrumentation. Success of firing from the standpoint of efficiency and safety depends to a large extent upon the fireman. Therefore, this factor bears consideration in selecting firing equipment.



Just a TWIST of the WRIST

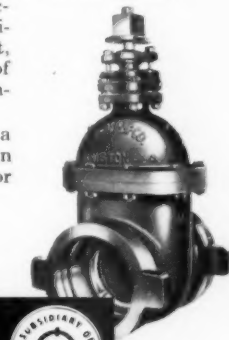
The three basic elements vital to your life are air, food and water. Most important of the three is water. And as civilization develops, water becomes increasingly important.

In America today, 140 gallons (60 pails) of water is required each day for every man, woman and child. It is a complex job to supply the water you need for home, industries, factories, stores, offices, schools, hospitals, fire departments and farms. To make water clear, healthful and tasteful it must first be settled, aerated, filtered and chemically purified. Millions of dollars must be invested in dams, reservoirs, pumps, filters, pipe, valves, hydrants. Design and construction of a water distribution system is a major engineering job—no two are exactly alike. Management, operation and maintenance requires knowledge of engineering, hydraulics, chemistry, business administration and "human nature."

Sometimes, when you take a shower or drink a glass of water, silently thank the water works man who makes it possible to do so night or day, winter or summer—with only "a twist of your wrist."

This Series is an attempt to put into words some appreciation of the water works men of the United States.

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Installation cost can be cut 1/3 to 2/3 with...

★ This Filter is also used extensively for swimming pool and industrial plant water filtration.

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Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL RJ because:—

1. The original cost of a diatomite plant for public supply is $\frac{1}{3}$ to $\frac{2}{3}$ the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces bacteria and removes organic matter to an exceptionally high degree with attendant low chlorination requirement. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.
5. Sparkler Filters can be used with pretreated water when such treatment is necessary or desirable.

Sparkler filtration engineers have introduced, in the RJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced developments in recent years.

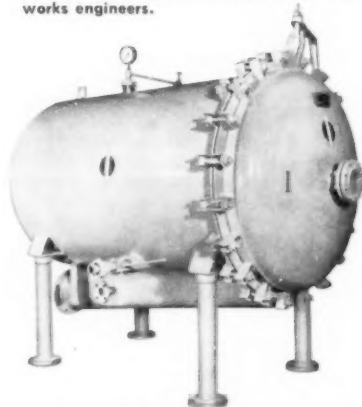
Less than 0.2% of the harvested filtered water is required to sluice and clean the Model RJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

Operators can be easily trained to handle this filter, highly skilled specialized personnel is not required to insure efficient performance.

Sparkler Model RJ filters can supply practically any required volume of city water. Single units with a capacity of 2,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.



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Snow Removal Equipment for the Illinois Toll Road

The Illinois Toll Road Commission is using Wausau Iron Works snow removal equipment mounted on 77 trucks to maintain 190 miles of the new road. This equipment includes



Wausau "V" plows, high speed one-way blade plows and underbody grader-ice blade equipment. The initial order included Wausau snow removal equipment for 27 FWD and 37 IHC trucks, which were followed by 13 IHC 4 x 4 trucks delivered during November.

Unusual New York State Thruway Facts

There are approximately 18,000 acres of right-of-way that must be mowed on the New York Thruway. Thruway construction consumed some 8,900,000 barrels of cement, equivalent to six-months' production of all cement factories in New York and Maine. Blueprints for the New York City to Buffalo section, if placed end to end, would stretch 315 miles, more than the distance from Albany to Buffalo. Each of the service areas on the Thruway has a water supply system large enough to service a community of 2,500 persons.

Reservoir Roofing Problem Solved by Acrylic Paint

Deterioration of the 40,000 square foot roof of the Dingee Reservoir at Piedmont, California, presented a maintenance problem to the officials of the East Bay Municipal Utility District. The simplest solution to this problem was to add a waterproof membrane system to the existing roofing of the 4,750,000-gallon reservoir. In the summer of 1957, the West Coast Roofing Company of Oakland, California, applied a combination of Pioneer Flintkote elastomer treated Hydralt coating and Yellow Jacket glass cloth. After the glass was thus bound, a single top coating of Pioneer-Flintkote green Rexkote acrylic polymer emulsion paint was applied by spray at the rate of $\frac{3}{4}$ gal. per 100 sq. ft.

PUBLIC WORKS for January, 1959

The Rexkote is compatible with the asphalt beneath and the properties of the acrylic film render the surface water and weather-resistant. Nearly molecular sized pores in the film permit the evaporation of water vapor from the materials beneath the film, thus inhibiting blistering. Moreover, the green paint provides a color which blends with the surrounding landscape. The paint has not faded, cracked, or lost its weather resistant properties and has remained in excellent condition. This unusual application of a coating formulated from Rohm & Haas Company acrylic emulsions points the way to further use of this type coating on roofs, patios and driveways.

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Waste Treatment by Aeration

(Continued from page 119)

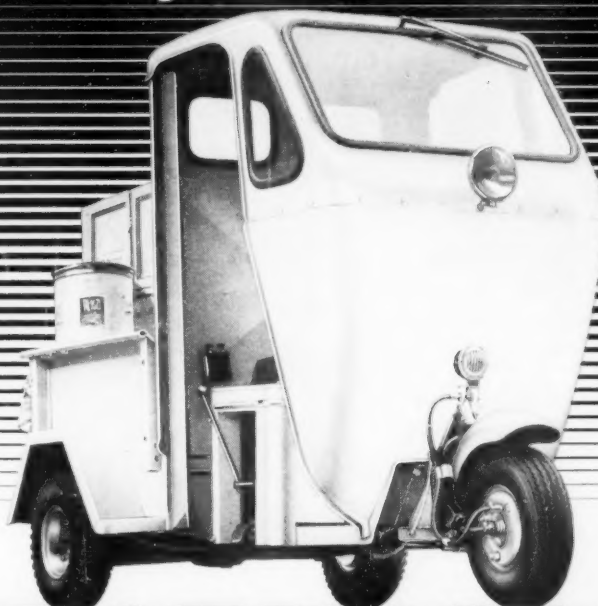
nor one process, can be considered superior for all conditions. The selection of equipment and process must be made to suit each individual problem—whether it is space limitation or changing load or changing receiving stream condition or the mixture of industrial and domestic wastes or any one of a number of conditions which call for engineering judgment. More than ever before, engineering judgment is essential if best use is to be made of modern techniques.

We can all be pleased that we are no longer restricted to one or two conventional processes which yield a high degree of treatment but often at prohibitive costs. Modern waste treatment encourages economy by providing only those facilities necessary to attain a specific goal—the protection of the receiving water for some specific use. There is no longer any excuse for designing a facility for the driest week during the year, only to have it be grossly oversized during the other weeks. This trend toward tailoring treatment to the need in the development of biological treatment we can all applaud.

References

1. Committee Report, "Sewage Treatment at Military Installations," *Sewage Works Journal*, 18, 791 (Sept., 1946).
2. Committee Report, "Standards for Sewage Works," Upper Mississippi River Board of Public Health Engineers and Great Lakes Board of Public Health Engineers, (revised July, 1954).
3. Committee Report, "Manual of Engineering Practice on Sewage Treatment Plant Design," Manual No. 36, ASCE and FSIWA (draft 1958).

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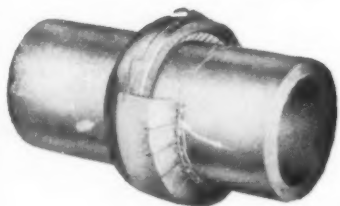
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4. Ullrich, A. A. and Smith, M. W., "Operation Experience with Activated Sludge-Biosorption at Austin, Texas," *Sewage and Industrial Wastes*, 29, 400 (Apr. 1957).
5. Eckenfelder, W. W. Jr., and Weston R. F., "Kinetics of Biological Oxidation," *Biological Treatment of Sewage and Industrial Wastes*, Vol. 1, p. 18-34, Reinhold Publ. Corp., N. Y., (1956).
6. Budd, W. E. and Lambeth, G. F., "High-Purity Oxygen in Biological Waste Treatment," *Sewage and Industrial Wastes*, 29, 237 (March, 1957).
7. Zieminski, S. A., Vermillion, Jr., F. J., and St. Ledger, B. G., "Aerator Design and Development," *Sewage and Industrial Wastes*, 30, 1238, (October, 1958).

• • •

Asphalt Pavement Design (Continued from page 80)

paragraphs a) through d) below, they may be used for the base provided they are scarified, thoroughly mixed at optimum moisture content and recompacted for the full depth of required base. Compaction requirements for these base course materials should be determined on the basis of AASHO Designation T180. Where minimum requirements for base course thickness are given below, they are considered to be applicable only to non-asphaltic base courses; thickness reductions may be made in these minimum values where quality asphaltic bases described above are used, based on the equivalency given. Detailed requirements for base courses are as follows:

a) Light Traffic—The base course should be of material classified in Fig. 1 as "Good Subbase" or better. It should be compacted to not less than 95 percent of the maximum modified AASHO density determined as noted above. Compaction should be accomplished so that compacted layers do not exceed 6 in. in depth. When a surface treatment is to be used as the asphalt pavement surface, however, the base course should be of material classified in Fig. 1 as "Medium Base" or better, meeting the compaction requirements outlined above.

The minimum thickness of the base should be such that the total thickness of base and pavement is not less than 5 in. Where the required total thickness of the asphalt pavement structure exceeds the 5-in. minimum thickness of base and pavement, additional base material may be used or, if more economical, a subbase may be included to provide the required total thickness.

b) Medium traffic — The base course should be of material classified in Fig. 1 as "Excellent Base."

It should be compacted to not less than 98 percent of the maximum modified AASHO density determined as noted above. Compaction should be accomplished so that compacted layers do not exceed 6 in. in depth.

The minimum thickness of base should be such that the total thickness of base and pavement is not less than 6 in. Where the required total thickness of the asphalt pavement structure exceeds the 6-in. minimum thickness of base and pavement, additional base material may be used or, if more economical, a subbase may be included to provide the required total thickness.

c) Heavy Traffic — The base course should be of material classified in Fig. 1 as "Excellent Base." It should be compacted to not less than 100 percent of the maximum modified AASHO density determined as noted above. Compaction should be accomplished so that compacted layers do not exceed 6 in. in depth.

The minimum thickness of base should be such that the total thickness of base and pavement is not less than 8 in. Where the required total thickness of the asphalt pavement structure exceeds the 8-in. minimum thickness of base and pavement, additional base may be used or, if more economical, a subbase may be included to provide the required total thickness.

For parking lots to be used only by passenger cars and light trucks of 6,000 lb. axle load or less, the required minimum thickness of base and pavement may be reduced to 6 in. with compaction requirements the same as noted above.

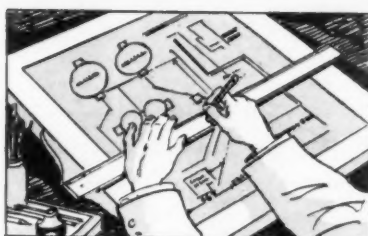
d) Very Heavy Traffic — Base course should be of material classified in Fig. 1 as "Excellent Base." It should be compacted to not less than 100 percent of the maximum modified AASHO density determined as noted above. Compaction should be accomplished so that compacted layers do not exceed 6 in. in depth.

The minimum thickness of base should be such that the total thickness of base and pavement is not less than 10 in. Where the required thickness of the asphalt pavement structure exceeds the 10 in. minimum thickness of base and pavement, additional base may be used or, if more economical, a subbase may be included to provide the required total thickness.

Type and Thickness of Subbase

Local materials are usually available near the construction site which

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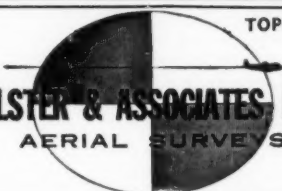
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are superior in quality to the subgrade material over which the asphalt pavement structure is to be built but yet do not meet the requirements for base course materials. Such materials are usually available at a fraction of the cost of high-quality base course materials and may be entirely satisfactory for use in the lower portion of the pavement structure. These materials may be used as a "subbase" and materially reduce the cost of the pavement structure.

Where a flexible pavement structure is to be built for heavy concentrations of traffic and/or high axle loadings over a very weak subgrade, a substantial thickness of subbase may often be used. In some instances it may even be economical to consider two types of subbase material, one of quality superior to the other. In such instances, the superior quality material is placed immediately beneath the base and above the poorer quality subbase. Where two such subbases are used the upper one is usually referred to as the "Subbase" and the lower may be designated as "Improved Subgrade." The designer must often "balance out" thicknesses of base, subbase and improved subgrade to achieve the most economical utilization of available materials.

Having determined the required thickness of the total flexible pavement structure and the minimum required thickness of base and pavement, the required thickness of the subbase should next be considered, if suitable materials are available for this purpose. Minimum quality requirements for subbase material may be determined by use of Fig. 1. in a manner opposite to that used to determine thickness of the total pavement structure. On the right-hand scale for "Total Thickness of Flexible Pavement in Inches" the minimum total thickness of the base and pavement, as noted on the bottom of Fig. 1. should be located. A straight line is drawn from this point, through the point representing the selected traffic classification and extended to the vertical axis on the left of the chart. From this latter intersection, a line is drawn horizontally to intersect the axle load curve being used to determine the required total thickness of the flexible pavement. Then, a line is drawn vertically to the appropriate scale of bearing values for the selected test method. The value thus derived is the minimum bearing value for the subbase material which may be used where the minimum allowable thickness of base and pavement is to be employed. For

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example, an asphalt pavement structure being designed for "Very Heavy" traffic and a 18,000 lb. axle load may be assumed. The minimum allowable thickness of base and pavement, previously discussed, is 10 in. Progressing from this 10-in. thickness as just described, it is determined that the subbase must have a minimum Resistance Value (R) of 58. If a sufficient quantity of such material is economically available, the minimum thickness of base and pavement previously established may be used and the additional thickness necessary to provide the required total thickness of flexible pavement may be of this subbase material.

If subbase material of the required quality is not economically available to fulfill these needs, it will be necessary to increase the base thickness as required. Again, Fig. 1 may be used for this purpose. For example, assuming the same conditions of axle loading and traffic classification cited in the preceding paragraph and that a subbase material having a Resistance Value (R) of 55 was the only one economically available, the required thickness of base and pavement for such a subbase would be determined in the same manner as for total thickness requirements. Starting with an R value of 55, progressing vertically to the 18,000 lb. axle load curve, horizontally to the left-hand axis, through the Traffic Classification point for "Very-Heavy" traffic and intersecting the scale for "Total Thickness of Flexible Pavement in Inches," the required thickness of base and pavement is indicated to be 12 in.

Under conditions of heavy concentrations of traffic, high axle loadings and very weak subgrades, it may be desirable, as noted previously, to consider the use of an "improved subgrade" material in addition to the subbase material. For example, assume the following conditions of design: Traffic classification, very heavy; axle load, 36,000 lbs.; and CBR value of subgrade, 3%.

By procedures previously discussed, it may be determined that the required total thickness of the flexible pavement structure is 26 in.; that the required minimum thickness of base and pavement is 10 in.; and that the minimum allowable thickness of base and pavement is used, is 15 percent. It is assumed further that two subbase materials are available, one having a CBR of 20 percent and the other a CBR of 8 percent, the latter being the more economical. For convenience and clarity in this example, the material

having a CBR of 20 percent is designated as "Subbase" and that having a CBR of 8 percent is designated as "Improved Subgrade." It is apparent that both materials may be used in the flexible pavement structure.

Data contained in the preceding paragraph indicate that the 10-in. minimum thickness of base and pavement may be used in combination with the subbase (CBR of 20 percent). Reference to Fig. 1 indicates that the improved subgrade (CBR 8 percent) requires over it a thickness of 15. in. Thus, 5 in. of the subbase and 11 in. of the improved subgrade in combination with the 10-in. thickness of base and pavement are adequate to meet the assumed design conditions.

Adequate compaction of subbase materials is essential to the satisfactory performance of the flexible pavement structure. Subbase material should be compacted at optimum moisture content to not less than 95 percent of the maximum modified AASHTO density. Compaction should be accomplished in layers not exceeding 6 in. in compacted depth.

In localities where freezing weather is to be expected, subbase and improved subgrade materials should be selected which are not susceptible to detrimental behavior upon freezing and thawing.

Here, again, it should be recognized that the thickness design of subbase and improved subgrade materials may require some "balancing out" by the designer to utilize local materials most effectively.

Economic Analysis

The final selection of the asphalt pavement design requires full consideration of a number of factors, some more difficult to evaluate than others. In addition to initial construction costs, consideration must be given to probable maintenance costs. Consideration must also be given to the level of performance expected of the facility, to the type of expected traffic, to past performance of similar types of pavements under local climatic conditions, to the availability of funds and other such factors.

It should also be clearly recognized that asphalt pavements are normally suited to stage construction techniques. In highway construction it may often be desirable to select a pavement section adequate to meet current needs and later to add additional base material and a higher-quality asphalt to adequately serve increased traffic demands.

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The South Bend Div. of the Curtiss-Wright Corp. announces the Model CW-226 and Model CW-220 self-propelled scrapers. The Model CW-226 is a two-axle scraper with a struck capacity of 26 cu. yds. and a heaped capacity of 36 cu. yds., and powered by a 375 hp diesel. The CW-220 is rated at 20 cu. yds. struck and 27 cu. yds. heaped, and is powered by a 375 hp diesel. This unit has the automatic transmission with 4 forward and 2 reverse speeds. Also the CW-220 scraper has the added advantage of being inter-



Model CW-220 scraper has a 20-cu. yd. struck and 27-cu. yd. heaped capacity

changeable with a 35-ton rear dump utilizing a Torgmatic brake for hydraulic retarding and control on steep grades. For complete details write to the South Bend Div., Curtiss-Wright Corp., South Bend, Ind., or circle No. 1-1 on the reply card.

Asphalt Mixer Produces A Better Batch

A new asphalt mixer that produces a closely knit mix and uniformity throughout a batch is announced by the Bollard Asphalt Plant Div. The mixer is of twin shaft design with the shanks and tips arranged for spiral run around and the high chromium alloy tips can be attached to the cast steel shanks with 16 possible adjustments. Repairs to the mixer or adjustment of the tips is accomplished easily without the need to remove any part of the structure over the mixer. Batches are kept hot throughout the mixing cycle by the 4 heating jackets on the outside surface of the shell. Each mixer can handle batches 5 to 10 percent in excess of its rated capacity. Mixers are con-

structed in 3, 4, 5 and 6-thousand pound batch capacities. Further information from Bollard Asphalt Plant Div. of the Colonial Iron Works, 17625 St. Clair Ave., Cleveland, O., or circle No. 1-2 on the reply card.

Rapid Sludge Removal Clarifier

Dorr-Oliver announces the availability of the SR clarifier, a new rapid sludge removal mechanism for final clarification in biological sewage treatment. This new clarifying unit provides immediate removal of freshly settled, biological solids for recycling to the aeration step. In operation, fresh biologically active sludge which has settled to the tank floor is channeled by deflecting plates to the open ends of the withdrawal pipes. This sludge is drawn up the pipes by head differential into the radial collection troughs. It flows to the central circular launder from which it is drawn off through the central discharge pipe. Grit and other inorganic solids are raked to a central sludge hopper and discharged by conventional means. Clarified liquor overflows a weir at the circumference of the tank. Rapid removal of activated sludge assures a fresher sludge with potentially less air demand when recycled to the aeration step. Prompt removal also prevents septicity in the final clarifier. The unit is available for tanks from 30 to 100 ft. in diameter. Further information is available from Dorr-Oliver Inc., Havemeyer Lane, Stamford, Conn., or circle No. 1-3 on the reply card.



One of two 30-foot diameter Dorr SR clarifiers operating at sewage plant

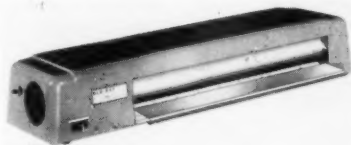
Wayne Model 460 Street Sweeper



Wayne three-cu. yd., three-wheel design sweeper being used on city street

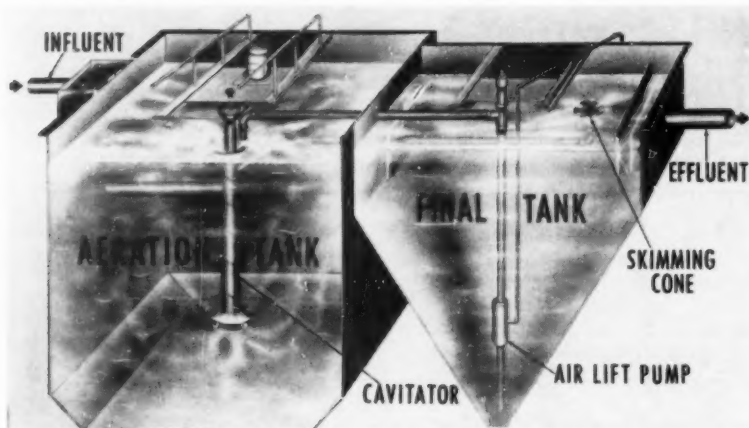
A new 3-cu. yd., 3-wheel design Model 460 street sweeper is announced by Wayne. The Model 460 is especially designed to provide maximum maneuverability, visibility and safety. The sweeper also incorporates rubber elevator drive chains of which many have been in continuous use in excess of fifty thousand miles. For more information write Wayne Mfg. Co., 1277 E. Lexington Ave., Pomona, Calif., or circle No. 1-4 on the reply card.

Printing Speed Increased 50%



The 1959 models of the Blu-Ray rotary Diazo printer incorporate several modifications, all contributing to increased speed and convenience. Printing speeds have been stepped up 50 percent by a revision of the light source and with an air cooling system to control interior temperatures and maintain optimum lamp temperatures for a maximum efficiency and usable life. A belt and pulley drive has greatly improved paper feed. A new aluminum feed table and matching trim strip have greatly enhanced the appearance and rigidity of the units. The units are offered in 42-in. and 22-in. machines. For full details write Reproduction Engineering Corp., Ivoryton, Conn., or circle No. 1-5.

Factory-Built Sewage Plant Shipped As One Unit



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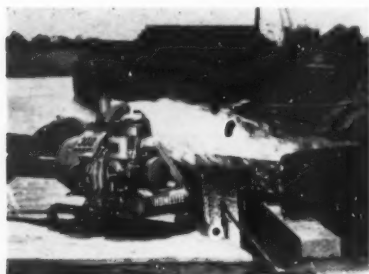
Aerobic digestion plants are low in cost, easily installed and highly effective

Sewage treatment systems for small installations can now be shipped as complete plants by Yeomans. Seven sizes are available in this Cavitator aerobic digestion plant, ranging from 2000 to 7500 gpd. Depending on the design criteria, this plant could handle a subdivision of 75 persons, a 30-unit trailer park or a 325-student ele-

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Self-Priming, Centrifugal Pumps

Three new pumps, the 300 series, have been announced by Homelite. These 3-in. self-priming, centrifugal pumps, with capacities of 18,000 gph, were specifically designed for all-purpose use by contractors, builders, construction men, utilities and municipalities. The Model 8 engine starts quickly, even in the coldest, wettest weather. The two-cycle engine design has fewer moving parts and is easy and inexpensive to maintain. All three models are guaranteed to pump and prime at 28 ft. above water level. The Model 8S3-1 is ideal for use in city and suburban areas and for emergency night operations where noise is a



Homelite pump has 18,000 gph capacity and will handle muddy and sandy water

problem. This pump has a total head of 65 ft. The Model 8S3-1P is for jetting, fire fighting, irrigation and other jobs requiring high discharge pressures. It delivers 102 gpm at 60 psi and total head is 185 ft. All three pumps, each weighing only 103 pounds, can be carried to any pumping site easily and quickly. For further information write Homelite, Port Chester, N. Y., or circle No. 1-7 on the reply card.

New Maintenance Ease for Water Softeners

A new automatic, multiple valve arrangement is now being offered by Allis-Chalmers to the users of industrial, institutional and utility water softener systems. This system uses individual, hydraulically operated valves which open or close automatically as required to regenerate the system. The individual valves mean easier maintenance at lower cost. Also newly available are manual pilot valves for fingertip control of large hydraulic valves in manual multiple valve systems. Complete data from Allis-Chalmers Mfg. Co., Industrial News Bureau, Milwaukee 1, Wisc., or circle No. 1-8 on the reply card.

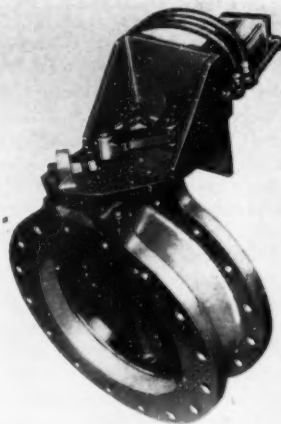
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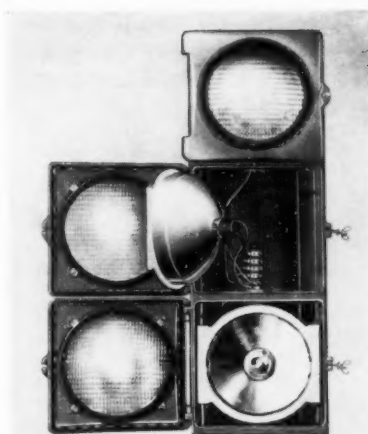
Makes Snow Removal Easy

The new 36-in. snow blade, just introduced by Speedex Tractor Co., will do an excellent, speedy job of clearing snow from walks, driveways and parking areas when attached to the S-8 walking tractor. This unit is powered by a 2¾-hp Briggs & Stratton engine. Two other lines are offered in addition to the S-8, the 5¾-hp and 9-hp riding tractors. For further information write to Speedex Tractor Co., Ravenna, O., or circle No. 1-9.

Improved Leopold Butterfly Valve

A number of new, improved features are offered by the advanced design Leopold AWWA butterfly valve. In this design, the new Uni-Wedge method of seat retention allows the seat retaining pressure to be externally adjusted with the valve in place in the line. Only two seat retaining screws are utilized, and these are not in contact with the flowing medium, so corrosion is not a problem. The valve disc and rubber seat arrangement at the disc hub are so designed as to eliminate premature seat failure. Every Leopold butterfly valve is equipped with a rugged flanged valve body, precision molded, nylon cloth reinforced, resilient rubber or synthetic seat, and heavy-duty corrosion-resistant operating parts. Other advantages of this new valve are: Simplified construction to minimize maintenance; positive drop tight operation; low initial cost; low head loss; and light weight. They are made for line sizes from 6 to 48 ins., for maximum line velocity of 8 or 16 fps, and for maximum shut-off pressures of 25, 50, or 125 psi. For more data write F. B. Leopold Co., Inc., Zelienople, Pa., or circle No. 1-10 on the reply card.





Signal has better light distribution

Crouse-Hinds Model M-3 Traffic Signal

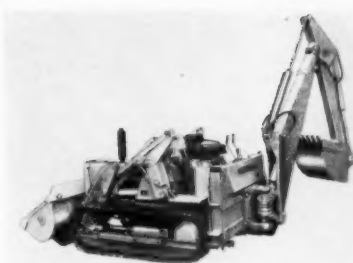
A completely new optical system, providing more light and better light distribution, is an important feature of the new Crouse-Hinds Model M-3 traffic signals. An improved lens with high-polish Alzak aluminum reflector eliminates sun phantom. Adjustable focus receptacles allow for lamp variations and the hood rim is constructed to prevent light leakage. Model M-3 is housed in a die-cast aluminum chassis enclosing 1, 2, 3, 4 or 5 sections. Each section is self-contained with integral top and bottom, for individual removal and replacement. One-piece reflector assemblies snap in, snap out. For more information write Crouse-Hinds Co., Syracuse 1, N. Y., or circle No. 1-11 on the reply card.

Improved Aeration in Treating Industrial Wastes and Sewage

An answer to the problem of discharging waste effluents into streams, sewers or lakes without danger of pollution is provided by Penberthy ejectors installed in activated sludge processes. This system cuts by 95 percent the high concentration of bacteria cells and is said to provide 20 to 25 percent oxygen absorption compared to a 4 to 5 percent absorption by porous plate or mechanical systems at a saving of over 40 percent in horsepower. Easily planned, properly balanced systems are simple to install and operate in new or present installations and they offer a practical means of providing supplemental capacity to existing facilities. Complete details from Penberthy Mfg. Co., 1242 Holden Ave., Detroit 2, Mich., or circle No. 1-12 on the reply card.

Buffalo-Springfield 3-5 Ton Tandem Roller

Features of the Buffalo-Springfield 3-5 ton tandem roller especially emphasized are: 1) The torque converter drive that automatically matches power to variations in grades and materials and offers infinitely variable speeds from 0.5 to 5.3 mph in either direction; 2) simple, easy servicing of precision aligned power unit assembly; 3) adjustable, wider faced bevel gears in the final drive which reduce tooth wear; 4) less frequent but easier adjustment of the high-speed, low-torque clutches; and 5) the large capacity hydraulic system that provides filtered, cooled oil through two circuits to the torque converter and transmission and for the power steering unit. More data from Buffalo-Springfield Roller Co., Div of Koehring Co., 1210 Kenton St., Springfield, O., or circle No. 1-13 on the reply card.



Deere Diesel-Powered Industrial Tractors

John Deere announces new diesel-powered industrial tractors, the "440" crawler and the "440" wheel models. The diesel engine has a 3 $\frac{7}{8}$ -in. bore and 4 $\frac{1}{2}$ -in. stroke, with rated hp of 33 $\frac{1}{4}$ at 1850 rpm. The "440" tractors will continue to be offered with gasoline engines. Both the diesel and gasoline engines are of 2-cylinder design. For further data write Deere & Co., Moline, Ill., or circle No. 1-14.

Five Major Improvements in Fox Sand Spreader

Designed for mounting on any standard dump truck in 15 minutes, the Fox River sand spreader now offers five new features. The new model dual-purpose spreader, for highway seal-coating in summer and de-icing in winter, incorporates these improvements: 1) An electrical control panel that permits the driver to regulate material from the dashboard without exposure to weather; 2) replacing a mesh-type screen, the new protective cover grid is made up of $\frac{3}{8}$ -in. rods spaced 3 ins. apart and centered in $\frac{1}{4}$ x 2-in. crossbars; 3) a new easy-working lever adjusts height of spinner

to regulate width of spread in four steps from 8 ft. to 40 ft. with most materials; 4) spinner shroud is now detachable for easy storage; and 5) a new (optional) V-shaped baffle plate can be mounted over auger to ease load of especially heavy materials (such as chips). Spreaders are available in four sizes, with capacities from 5 to 8 cu. yds. heaped. The spreader operates effectively at truck speeds from 5 to 40 mph. For further information write to Fox River Tractor Co., Road Machinery Div., 1020 N. Rankin St., Appleton, Wis., or circle No. 1-15 on the reply card.



Fox River sand spreader is used for sealcoating in summer and de-icing in winter



Anderson mower can cut on other side of road barriers and in inaccessible places

Extension Sickle Bar Mower For Difficult Places

A revolutionary new idea in hydraulic mower design has vastly extended the areas where tractor mounted sickle bar mowers can be used. Costly, time consuming hand mowing operations are virtually eliminated in many areas by this new Anderson hydraulic extension mower. The new idea is a dual extension arm linking the tractor to the conventional sickle or cutter bar. In retracted position, the cutter bar mows in normal fashion, close to the tractor. By moving the hydraulic control levers, the operator can quickly move the cutter bar to any desired angle, height or distance from the tractor far beyond the capabilities of conventional equipment. It can reach over most high-

way fences or other barriers and mow close to the edge, and at any angle. The reverse slope of ditches can also be cut with equal ease. The unusual flexibility and positive control of this mower is made possible by the Anderson balanced hydraulic system. Positive knife speed is maintained even when maneuvering the cutter bar and extension arms, an important factor on uneven terrain. If the cutter bar strikes an unmowable object, such as a hidden rock, the breakaway latch trips and swings the cutter bar clear. The cutter bar is rapidly reengaged by the operator without leaving his seat. Additional information from A. C. Anderson, Inc., Dept. 128, Wildwood, N. J., or circle No. 1-16

Automatic Copying Machine

The Porta-Fax, an automatic copying machine, is electrically operated and provides virtually all big machine advantages, yet it is bantam size and completely portable. Equipped with a carrying handle and weighing only 18 lbs., it measures 18 ins. long by 6 ins. deep by 10 ins. high. It handles sheets up to 9½ ins. wide and of any length and reproduces from all colors and ball point pen. It is a self-contained unit that prints sharp, error-free copies



Completely portable copying machine can reproduce 60-90 copies per hour

at the rate of 60-90 copies per hour. For further data write the General Photo Products Co., Inc., General Photo Building, Chatham, N. J., or circle No. 1-17 on the reply card.

Pitman Adds New Model Hydra-Lift

It lifts up to 5,000 lbs., requires only 22 in. behind a truck cab, is completely hydraulic and the boom rotates a full 360°. These are principal features of a new Model 50 Hydra-Lift, announced by Pitman. The boom can be carried over either the cab of the truck or the bed. The new crane has controls on both sides and is available in 3 models. One has a fixed length boom, 12 ft. long. The second has a boom that telescopes manually from 12 to 16 to 20 ft. The third telescopes hydraulically from 12 to 20 ft. Complete details from Pitman Mfg. Co., 300 West 79th Terrace, Kansas City, Mo., or circle No. 1-18 on the reply card.

Trojan Tractor Shovel Has Range From 1¼ To 2 Cu. Yds.

The Trojan 124, a 4-wheel drive tractor shovel has three interchangeable buckets; a 1½-yard general utility bucket; a 1¼-yard heavy material bucket; and a 2-yard light material bucket. The 10,000-pound lifting capacity of the unit permits it to function at maximum efficiency with any of the three buckets in operation. Shifting into any of the forward and reverse speeds can be done at full throttle without stopping at any point. The travel speed ranges from 3 to 21 mph in third, in both forward and reverse. Finger-tip steering control is provided by hydraulic power steering. It has a dumping clearance of 10 ft. 3 ins. under the hinge pin, and 8 ft., 4 ins. under the bucket cutting edge. Full data from The Yale & Towne Mfg. Co., Trojan Div., Batavia, N. Y., or circle No. 1-19 on the reply card.

Dempster-Dumpmaster Refuse Collector

Development of an economy priced Dempster-Dumpmaster refuse collector has been announced by Dempster Brothers. The new self-loading packer is a smaller version of the original 24-cu. yd. model. Known as the CA-15-18DB, the new Dumpmaster has a capacity of 72 cu. yds. of loose refuse in its 18-cu. yd. body. The unit was developed for use in areas where containers 3 cu. yds. and under are employed, and for hand-loaded collection routes where conventional trash cans are used. A special container, with a low loading height, is carried on the lifting arms for manual collection operations. The safety clearance arms, which bridge the cab doors have a gross lifting capacity of 3,000 lbs., handling 1, 2 and 3-cu. yd. containers. The packer plate has a compression force of 58,000 lbs. and is activated by a 4-stage telescopic hydraulic cylinder. For full information write to Dempster Brothers, Knoxville, Tenn., or circle No. 1-20 on the reply card.



Collection body has a capacity of 72 cu. yds. of loose garbage and rubbish

High Reach Telescope for Outdoor Lighting Maintenance



Unit for roadway lighting maintenance

A 500-lb. capacity high reach telescope for the installation, maintenance and replacement of outdoor lighting in street and highway illumination, bridge lights and signs and parking lot lighting is announced by Economy Engineering. This telescope can be used with utmost safety at heights to 42 ft. and the unit includes many mechanical safety features. It can be transported conveniently by hitching to any kind of vehicle or truck. Electrically elevated models are available as well as hand operated units. For complete details write Economy Engineering Co., 4509 W. Lake St., Chicago 24, Ill., or circle No. 1-21 on the reply card.

Four-Wheel-Drive H-90 Payloader

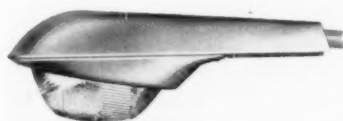
The Frank G. Hough Co. has announced a new rubber-tired, four-wheel-drive model, the H-90 Payloader. It will replace the former HO model. Load carrying capacity is 9,000 lbs. at average travel speeds. Both gas and diesel power units are offered. Buckets to handle materials of various weights within the recommended carry capacity are available in sizes from 1½ to 5 cu. yds. The H-90 has a breakout force of 21,000 lbs. and a bucket tipback of 44° at ground level. It has torque-converter drive, power-shift transmission and new heavy-duty planetary axles. Complete details from The Frank G. Hough Co., 761 Seventh St., Libertyville, Ill., or circle No. 1-22 on the reply card.

Portable Electric Diamond Core Drill

The Geo-Drill Co. offers a portable diamond core drill and accessory diamond bits for drilling close-tolerance pavement. This compact unit can drill vertical, horizontal or angle holes. The drill column can be lowered to the base and the unit rolled on its two roller bearing wheels. It is driven by a 1½ hp, 110-220 volt, 60 cy., AC electric motor which develops a bit speed of 1000 rpm. For more details write Geo-Drill Co., P. O. Box 6, Bridgeville, Pa., or circle No. 1-23 on the reply card.

Luminaires for 400-Watt Mercury Lamps Have Built-In Ballast

A new line of mercury luminaires for street lighting is available from Westinghouse. Designated the OV-25 Silverliner luminaires, the units are supplied with 400-watt mercury lamps, and are available with or without built-in ballast. The new luminaires have one-piece die-cast aluminum housings, for high strength and low weight. The built-in-ballast model weighs 46 lbs.; units without ballast weigh 20 lbs. Easily handled, the Silverliners can be installed by one man. Two dual-voltage regulated output ballasts are available. In the built-in-ballast model, the transformer and capacitor compartments are separated by a heat barrier to assure longer



Lighting luminaire from Westinghouse capacitor life. Designed for maximum light output, Silverliner refractors are combined with a tilted optical system for optimum distribution. A selection of refractors gives a choice of either type II or type III light distribution. For further information write Westinghouse Lighting Div., Edgewater Park, Cleveland, O., or circle No. 1-24 on the reply card.

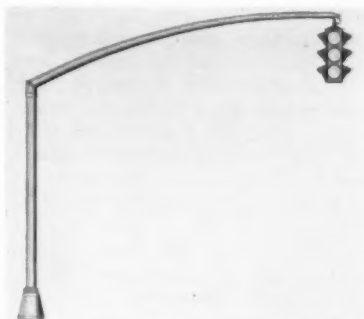
Caterpillar Scrapers

Two scrapers are now available for service with the Caterpillar DW20 wheel tractor, announces Caterpillar Tractor. The No. 482 has a 24-yd. struck-capacity and the No. 456 has a capacity of 18 yds. Job conditions will determine which

unit will best serve to return maximum profit on individual earthmoving projects. In general, the No. 482 finds the most economical application in good loading conditions, where haul road grades are at a minimum, and rolling resistance is low. The No. 456 can best serve on jobs where adverse grades and average to high resistance haul road conditions are encountered. The No. 482 incorporates a number of features designed to insure long service life of scraper components. Paramount among these is the location of the bowl lift sheaves in the draft frame spreader tube. The bowl lift cables are attached directly to the bowl sides. This gives maximum protection from dust and fouling of the bowl lift sheaves and cables, providing optimum sheave and cable life. Write Caterpillar News Service, Peoria, Ill., or circle No. 1-25 on the reply card.

Traffic Signal and Lighting Standard

The new cantilever design, named the Classic and made by Kerrigan Iron Works for traffic signal and lighting standards is an attractive design that will blend in well with the new streets and highways being constructed. The design is in keeping with the trend to functional, streamlined styling and eliminates much banjo work, making installation and maintenance a much simpler job. The traffic signal standard has been designed to eliminate vibration or flutter, and has been tested for winds of hurricane velocity. Available in steel or aluminum, it can be rotated to any particular point within a 360° circle. It is available with arms 10, 12, 15, 18, 20 and 25 feet in aluminum and up to 35 feet in steel; and its matching lighting standard with arms 4, 6, 8 and 10 feet in both steel and aluminum. For more data write the Kerrigan Iron Works, Inc., Nashville 2, Tenn., or circle No. 1-26 on the reply card.



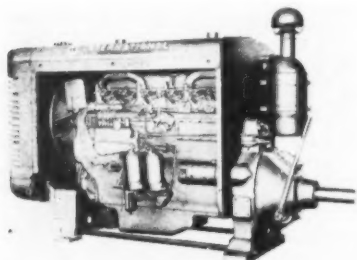
Kerrigan Iron Works signal standard

E-M Announces Brushless Generator Line

The first basic change in generator design for a-c power has resulted in the development of brushless generators. These machines have neither commutator, slip rings nor commutator brushes and slip ring brushes. Available in ratings from 6.25-187 kva, the generators are complete with static voltage regulator and meters. The E-M line is available at 1200 and 1800 rpm. Broad range voltage is standard. For more details write Electric Machinery Mfg. Co., Minneapolis 13, Minn., or circle No. 1-27 on the reply card.

4 New IHC Power Units

IHC's growing line of power units has been augmented with the addition of four new diesel models. The six-cylinder UD-554 boasts 121 net hp at 1,800 rpm, and the four-cylinder UD-370, 80 net hp at the same rpm. Both engines have many interchangeable parts, among them cylinder sleeves, pistons, connecting rods and injectors. Dependable, all-weather push-button starting is an extra advantage for use in such machines as $\frac{3}{4}$ to $1\frac{1}{4}$ -cu. yd. shovels, medium and heavy-duty



Leading the line of four new diesel power units is the UD-554 unit shown above. As an engine, it develops 150 maximum belt horsepower at 2,300 rpm

motor graders, 50 and 75-KW maximum output generators, 250 and 400-cfm air compressors (1,800 rpm), portable saw mills, irrigation and drainage pumps, heavy-duty road rollers and medium and heavy-duty ditchers and trenchers. The other members of the diesel power unit quartet, the UD-282 and UD-236, are six-cylinder, direct-start models. They develop 85 net hp at 2,400 rpm, in the case of the UD-282, and 65 net hp at the same rpm for the UD-236. For more details write Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle No. 1-28 on the reply card.

Optical Micrometer Theodolite

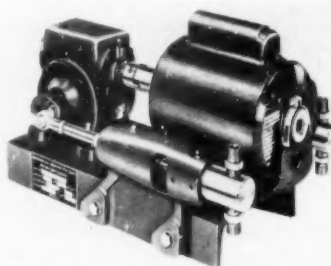


Theodolite reads directly to 20 secs.

The optical micrometer theodolite, introduced by Precision Instrument, is an English theodolite that reads directly to 20 secs. of arc and by estimation to 5 secs. Among its outstanding features are the brilliance of field of the circle-reading microscope, high degree of magnification which can be applied to the graduation system and the extremely convenient reading position. The telescope is of the internal-focusing type with spiral focusing eyepiece. The instrument weighs 9 lbs. For more data write Precision Instruments Inc., 1900 Fifth Ave., Troy, N. Y., or circle No. 1-29 on the reply card.

Proportioning Pump

Series 100 controlled capacity pumps, just introduced by American Meter Company, have been developed to handle many applications in water treatment. The Series 100 Simplex models handle capacities ranging from 0.65 gph to a maximum of 13.10 gallons at a maximum pressure of 1000 psi. Duplex

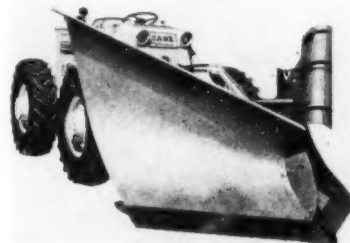


Pumps are controlled capacity units for moving specific volumes of fluids

Series 100 models are rated at double the capacities of the Simplex models. Capacity regulation is easy and accurate. A screw adjustment on the crank adjusts the stroke while the pump is stopped. All Series 100 pumps are driven by standard NEMA frame fractional horsepower motors. Electric motor is open, drip proof, single phase, 60-cycle, 115-volt. For more details write American Meter Co., Pump Div., 13,500 Philmont Ave., Philadelphia 16, Penna., or circle No. 1-30.

Snow Plows Now Available For Case W-9 Terraload'r

V-type and adjustable angling snowplows are now available for the Case W-9 Terraload'r. The V-type plow has spring-loaded deflectors at top of the blade which can be adjusted for varying snow conditions and clearing requirements. The plow rides on three oscillating skid shoes which are adjustable for setting height of cutting edge above surface or road. Cutting edges and rounded nose at leading point are replaceable. Available in both light and heavy duty models, the angling snowplow can be angled right or



left up to 41° on the former and 31° on the heavier units. Both models feature float springs which allow the blade to deflect upward, thereby reducing shock when striking raised objects, and assuring better snow clearing action. For more data write J. I. Case Co., Racine, Wisc., or circle No. 1-31 on the reply card.

Correction for Crane Carrier Corp.

In the New Equipment section of the November issue it was stated that the Crane Carrier Corporation makes and sells the Samson multiple-purpose excavator. This is incorrect for the excavator is made by Avery Tractor, Inc., West Lebanon, N. Y. The excavator is mounted on a carrier which was custom made by the Crane Carrier Corporation. CCC offers a complete program to assist equipment manufacturers in product development that will solve any problem of mobility.

Purdue Industrial Waste Conference

The 14th Purdue Industrial Waste Conference will be held May 5-7 in the Memorial Union Bldg. Full information can be obtained from Don Bloodgood, Prof. of Sanitary Engineering, Purdue University, Lafayette, Ind.

Louisiana Water & Sewage Short Course

The 22nd Annual Short Course for superintendents and operators of water and sewerage systems will be held at Louisiana State University, Baton Rouge 3, La., on March 18-20. Dean Fred H. Fenn, College of Engineering, will furnish further information.

NEWS OF ENGINEERS

ROY L. PHILLIPS, city engineer of Meadville, Pa., from 1928 to 1956, died recently. A well-known engineer, active in many fields, he had held numerous offices in engineering societies and had been the recipient of many honors.

JACK WOOD has become an Associate of the firm of Harland Bartholomew & Associates, St. Louis, Mo., Planners, Engineers and Landscape Architects. Mr. Wood has been Professor at the University of Illinois and recently has been assigned to the Indian Institute of Technology, Kharagpur, India.

WM. HUNTER OWEN has joined the consulting firm of Barge, Waggoner and Sumner, Nashville, Tenn., as an Associate. Mr. Owen has been Assistant Director of the Tennessee State Sanitary Engineering Division, Dept. of Health.

GEE & JENSON, Consulting Engineers of West Palm Beach, Fla., have opened a new branch office at 502 Main St., Dunedin, Fla., which will be in charge of W. A. Arnold. Other branch offices are located in Cocoa and Ft. Myers.

MATHEW C. SIELSKI is the new president of the Institute of Traffic Engineers. Mr. Sielski is Director of Traffic Engineering & Safety for the Chicago, Ill., Motor Club. Edward G. Wetzel of the New York Port Authority and A. F. Malo of the Detroit Dep't. of Streets and Traffic are vice-presidents.

W. D. HUDSON has succeeded CYRUS R. BIRD as Vice President and Western Manager of Pitometer Associates. Mr. Bird is retiring; Mr. Hudson, who has been in charge of the Atlanta, Ga., office since 1950, will transfer to Chicago.

CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

Water Utility Manager-Engineer

Registered graduate engineer to manage, and to design and supervise routine construction and expansion of 3500 account water system. Applicant must have experience in utility work and management. Position has usual fringe benefits, and community has excellent living conditions. Salary: \$6,000-\$7,500. Send experience resume and full personal details to: State College Borough Authority, 118 South Frazier Street, State College, Pennsylvania.

WATER PRODUCTION SUPERINTENDENT San Diego, California Salary to \$909 mo.

Engineering degree and 5 years supervisory experience in water impounding and treatment. 95 personnel and million-dollar budget. Write immediately if interested! City Personnel, Room 453, Civic Center, San Diego, California.

Graduate Sanitary Chemist Wanted

Must have minimum of two years experience in water or sewage treatment laboratory and be qualified for bacteriological analyses. Applications accepted through January 31. For details send brief resume to Superintendent Waste Treatment, City Hall, Waterbury, Connecticut.

PUBLIC WORKS DIRECTOR

Charleston County, South Carolina. \$725-\$905. Longevity pay. Graduate, registered Civil Engineer. Five years responsible public works experience. Apply County Manager, Room 8 County Center Annex, Marion Square, Charleston, South Carolina.

SPECIAL REPRINT OFFER!

Following three reprints are being offered at special reduced prices.

- The Use of Photometric Instruments for Colorimetric Analysis of Water and Wastes.

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FOR SALE

ITEM 1: Two General Electric Trichel induction motors, Model No. 5K504XAD, 100 HP, Service Factor 1.15 at rated voltage. Type K, Code F, Frame 504P, 3 phase, 440 volts, speed 1765 RPM. Serial numbers UHJ6920008 and UHJ6920011. Complete with two General Automatic Compensators Type CR7051-CIF, Catalogue No. 8660978XG3 HP66-100, volts 440, 60 cycle, 3 phase Control Voltage 440 volts.

The above equipment used less than 100 hours on vertical turbine high pressure pumps.

ITEM 2: One Complete Blackburn-Smith pneumatic sewage ejector system, consisting of 2 ejectors having a total capacity of 60 gallons per minute against a total head of 55 feet, 2 Kraissel air pumps, size 25-13WJR complete, 5 HP, 3 phase, 208 volt motors and controls.

The above equipment used less than 6 months.

For further information write:

Mr. George C. Wright, Manager
Board of Public Works
P.O. Box 312
Gaffney, South Carolina

CONSTRUCTION ENGINEER

An expanding midwest pharmaceutical company has an opportunity for a field engineer to keep in contact with the details of construction work such as proper backfilling, adequate piping testing, utility piping, all mechanical work, proper concrete mixes, etc. This man should have 6-10 years of varied experience in both mechanical and structural phases of construction. Write stating background and experience to:

Technical Employment Coordinator
THE UPJOHN COMPANY
Kalamazoo, Michigan

REPRESENTATIVES WANTED

ATTENTION: Contractor's Supply Houses, Manufacturing Agents representing Traffic Control and Safety Products and Public Utility lines. The nation's oldest and largest manufacturer of the most complete traffic control and safety line is interested in expanding representation. The products are of a supply nature and provide a self-generating repeat volume.

For further information write to:

Box 1-1

Care of Public Works Magazine

Sales Representatives Wanted

A manufacturer of a very useful small hoist, 1/4-ton capacity, which is truck-mounted and operated from the truck battery, desire sales representatives who contact cities and counties. These hoists are utilized by many departments, as street and highway, water, sewerage, fire, park, etc. Write to Burtchell Heating Co., 2944 SE Powell Blvd., Portland, Oregon, for full details on this labor and time-saving device, including special applications.

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WORTH SEEING



Up on the Quebec-Chicoutimi road in the Canadian Laurentians they don't send a boy to do a man's work in snow removal. So the Provincial Government sends a Huber-Warco 5D-150 motor grader with power sliding moldboard and a snow blower to take over and extend the ordinary plow's cut beyond the ditch line, making room for added snowfall.

General Electric, International Harvester and Union Metal here combine their equipment toward making State Street in Chicago the world's most brilliantly lighted thoroughfare. At left is shown an International model A 160 truck with Elliot Hi-Reach boom installing GE fluorescent luminaires on special standards made by Union Metal Mfg. Co.



Unusual design is used for the 10 MG clearwater storage basin under construction for the St. Louis Water Department Chain of Rocks plant. Each wall of the square basin is 281 ft. long and 30 ft. high, and is formed by 15 hollow concrete cells. These are interconnected so inspectors can examine the interior. The roof is a flat concrete slab supported by



225 columns. An interior drainage system at the roof and ground levels will carry away any ground water which might penetrate the cells and will relieve hydrostatic pressure from high water tables. Approximately 11,500 c.y. of concrete will be used in the basin, with 928 tons of Laclede multi-rig round bars and other Laclede steel reinforcement.

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by Arthur K. Akers

★ **HAPPY NEW YEAR** to all! Evidence is already in that it will be one to confound the pessimists of early 1958. So, let's go!

★ **WEMCO** Division of Western Machinery Co., San Francisco, through whose pumps passes "anything that will go in," announces Preston H. Mulcahy as its new general manager.

★ **PHILIP KERRIGAN** Jr., president of Kerrigan Iron Works, Nashville, passed away in late November of a heart attack. He was 54.

★ **REAL ORIGINALITY** in public relations interests us all. We cite the three stewardesses on Delta's flight #725 Nov. 7th who, instead of the stereotyped "Welcome aboard" over the plane's P.A. system, sang us a welcome of their own composing "from Margaret, Mary and Sue." Applause swept the ship, and we felt better all the way to New Orleans.

★ **AMERICAN BITUMULS** and Asphalt Co. expands again; this time a new 2 million-gallon facility to provide for the fast-growing interstate highway construction program. It will be in operation for the 1959 season, at St. Paul, Minn.

★ **CITY TANK** Corporation announces appointment of A. S. Lawrence as vice-president and general sales manager. His responsibilities include their Roto-Pac refuse collectors, bituminous distributors, etc.

★ **ROBERTS FILTER** Mfg. Co., Darby, Pa., names Jesse W. Roberts vice-president and John W. Burton general manager.

★ **PFAFF & KENDALL**, Newark, N. J. appoint Forrest E. Pope, Burlingame, Calif., as western sales manager in seven coast and mountain states.

★ **WRITING** us on another matter. President George R. Dempster of Dempster Brothers, Knoxville, encloses a \$20 Confederate bill, "the only currency recognized for invited

guests" at their plant cafeteria. We thank Mr. Dempster and plan an early lunch.

★ **THE FIRST** annual Leap Associate conference on prestressed concrete will be held Jan. 19-20 in Lakeland, Fla., with some forty-two producers taking an active part.

★ **3-M COMPANY** makes the New York newspapers with its new "handbag martini," described as the first really portable martini for the ladies. Those who know 3-M through its reflective highway traffic signs can chalk up a new plateau of achievement here.

★ **A NEW W. S. Dickey** Clay Mfg. Co. plant will rise soon in the Birmingham suburb of Bessemer, Ala. It will include the latest innovations in clay products manufacturing.

★ **WILLARD F. HALL** is named assistant sales manager, International Harvester Co.'s Construction Equipment Division.

★ **ANDREW W. ROSE** is named president of Byron Jackson Division (pumps to you) succeeding E. S. Dulin, upped to chairman of the board.

★ **FISHER RESEARCH LABORATORY**, Palo Alto, Calif. has built a

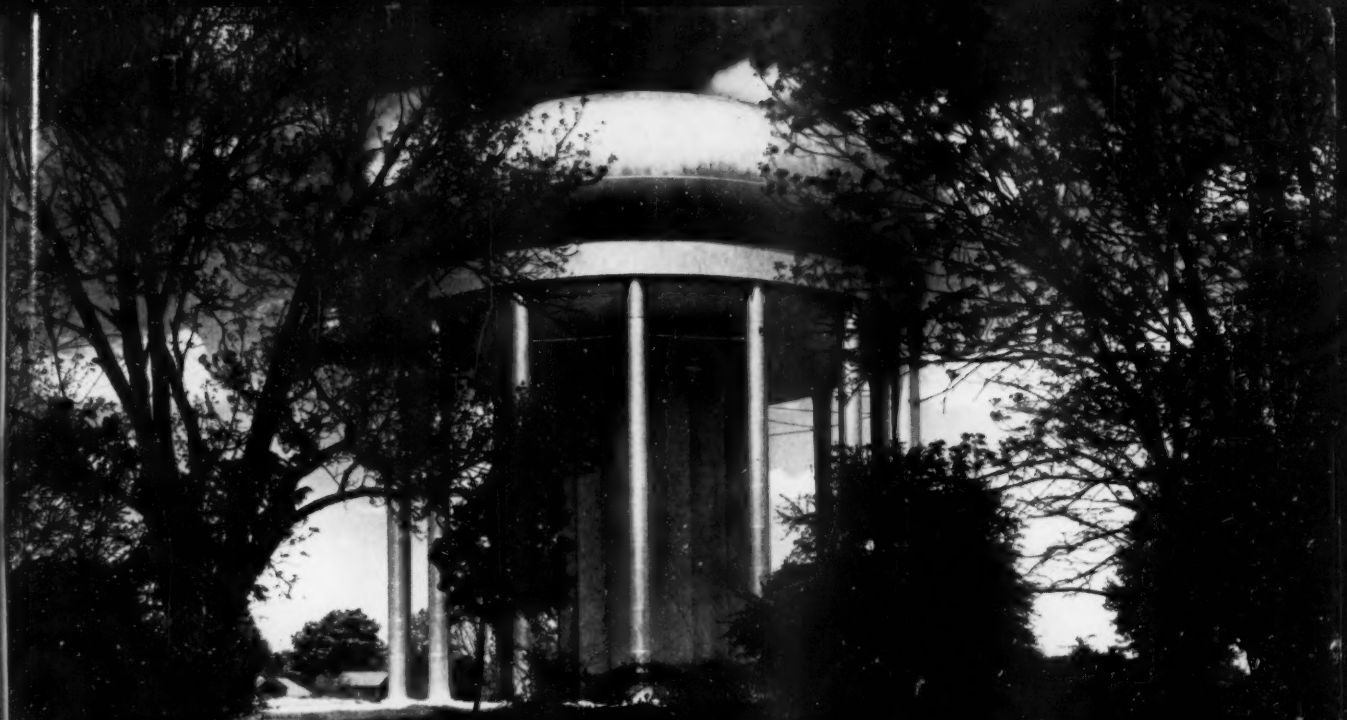


new home which includes facilities for manufacture of their Fisher M-Scope pipe finders and leak detectors.

★ **EDWARD A. ATWOOD** joins Vulcan Materials Co., Birmingham, as director of advertising and public relations.

★ "WELL, doctor, was my operation a success?" "Who's a doctor? I'm St. Peter."

—Huber-Warco News



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fied *known* amounts of differential settlement, which do not affect the utility or safety of the structure.

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Below: 10,000,000-gal. Horton® reservoir helps to supply increased water needs at Spokane, Washington. Structure is 240-ft. in diameter.



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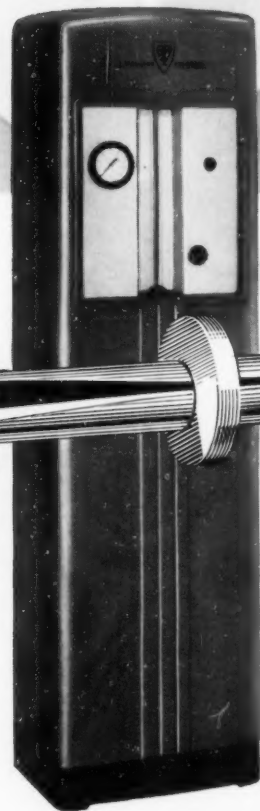
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